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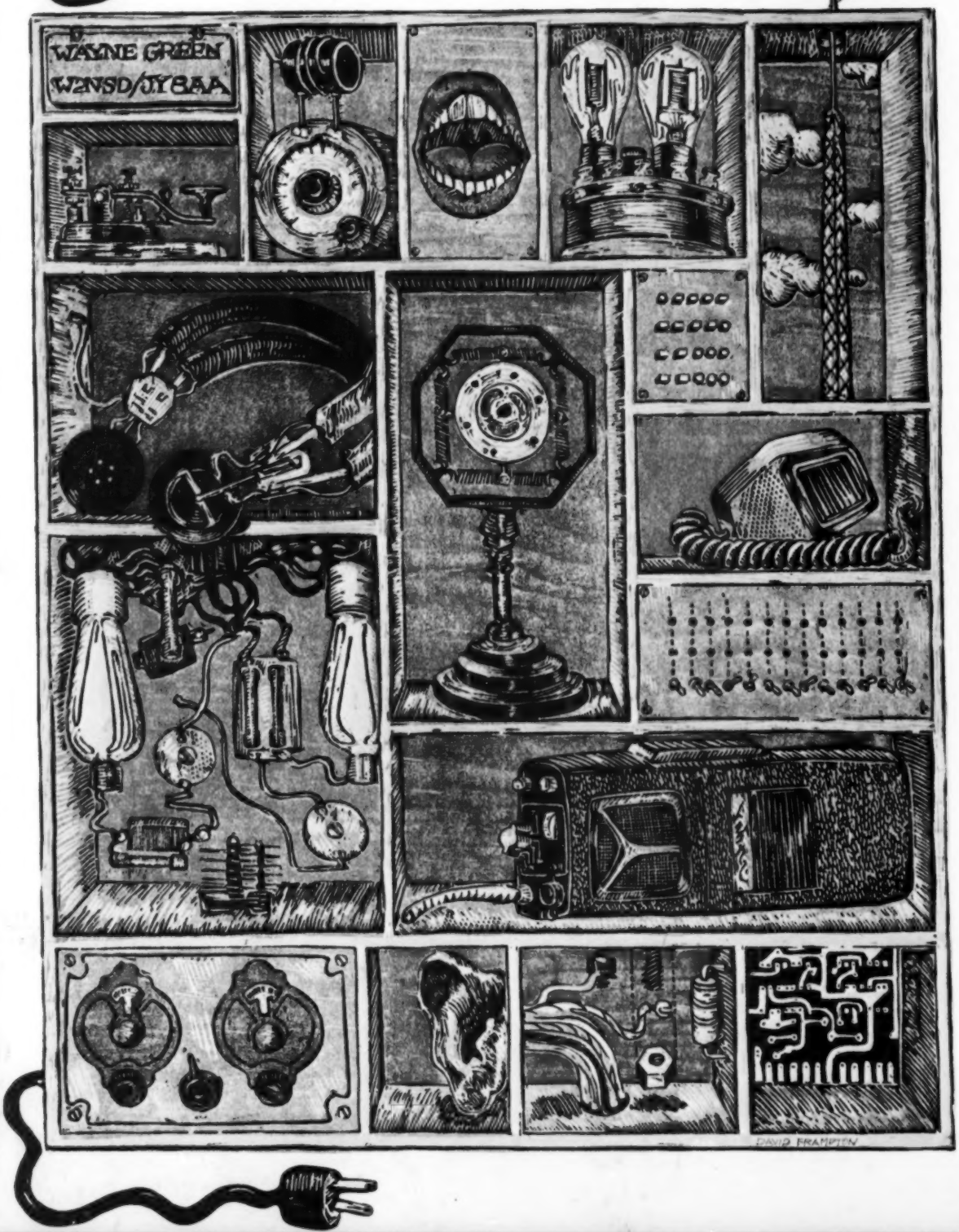

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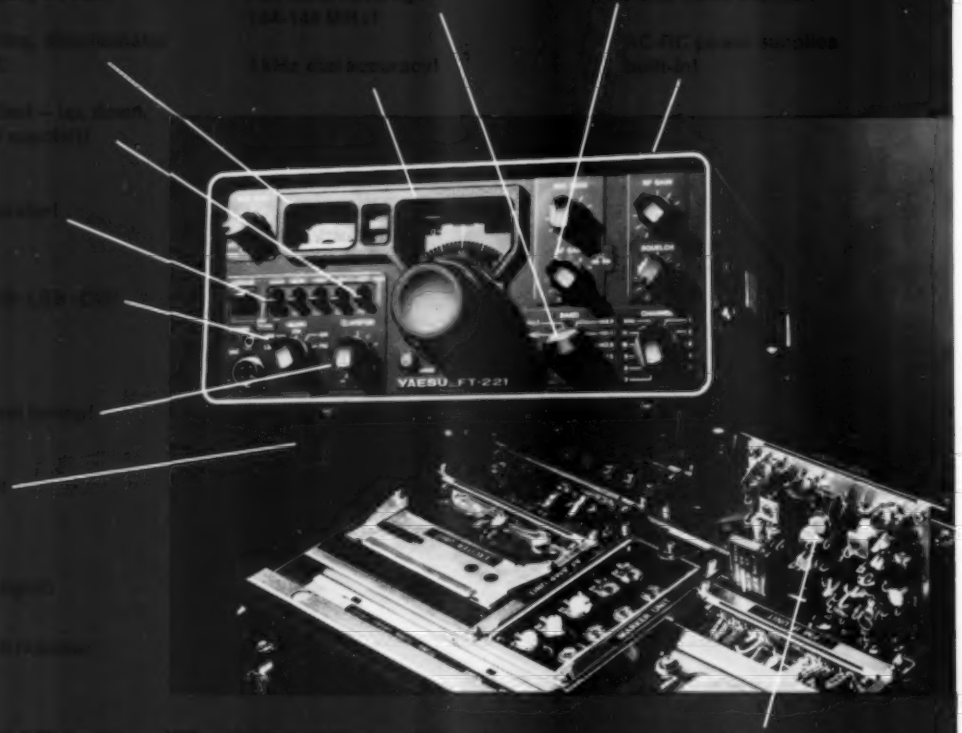

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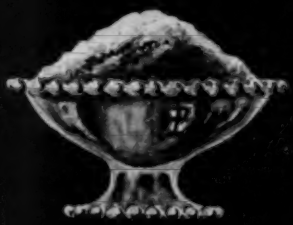

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NEVER SAY DIE

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EDITORIAL BY WAYNE GREEN

Since one of the basic reasons for the amateur "service" is the pioneering and inventing we do (97.1b), the FCC is going against its own rules when it prevents amateur experimenting and pioneering. Why doesn't some national club haul the FCC into court and force them to obey their own rules?

The FCC has a long history of making it somewhere between difficult and impossible for amateurs to live up to 97.1b. Their recent refusal to permit experimenting with ASCII on the low bands, using as an excuse the bandwidth docket which is under consideration, is a typical example. Here we have a docket which the FCC admits can take several years to conclude and it is used as a reason for preventing the development of amateur techniques. Many FCC rule-making procedures take from three to five years to complete, and amateur radio just cannot afford to move at such a snail's pace.

This is no worse than the excuses used in the past to prevent amateur experimenting ... for years the FCC refused to allow amateurs to use any mode of emission which their monitoring stations were not set up to copy. Amateurs were held back for years in RTTY developments as a result of this restriction.

If the FCC has no real intention of permitting amateurs to live up to the rules as written, then they should at least be honest about it and delete 97.1b from the regulations ... and they should explain to us why they have deleted this.

When you consider what amateurs have been able to do, despite the efforts of the FCC to smother the ham creative urge, it is a miracle. I wonder what might have developed if we hadn't had to fight the FCC every inch of the way?

I'm exaggerating, you say? Take a look at the way repeaters developed before the FCC got into the act. We had things really moving along ... with a repeater network up and working on a daily basis where a chap could talk from San Diego to Phoenix to San Francisco. I stood on a street corner in Las Vegas a few years ago and talked with a chap in San Diego, one in Los Angeles, and one in Phoenix in a round table. The FCC outlawed this sort of progressive nonsense and the net went underground.

Before the FCC cracked down on experimenters, there were some repeaters going between 2m, 6m, 10m, and even 20m. My own repeater was set up so it could be made to work between two and six meters ... then we added ten meters and the repeater users were able to talk from an HT via two meters with amateurs all around South America. I set up another repeater for 2m-20m work and worked DX while walking anywhere around town with an HT.

More and more repeater groups were expanding the services of their systems ... some to six meters, some to 220 MHz, some to 450 MHz. All this got stopped when the repeater regulations were made into law ... and the result has been a serious drop in the activity on both 6m and 220 MHz. How can we get the FCC to leave us alone so we can try different systems ... invent new modes ... and pioneer new ideas?

For a while, after the January, 1974, hearing before the Commissioners, it looked as if the Commission was going to try to turn over a new leaf and ease up on the restrictive amateur regulations. They have, to some degree, followed through with this, but they've hardly made the amateur service an example of deregulation.

The FCC might work on the basis of permitting experimentation during discussions of rule changes rather than prohibiting it. If they eventually prohibit a certain mode, then we would have to stop using it. This would be better than waiting three to five years to even start experimenting.

Speaking of the bandwidth docket, perhaps we would do better if we convinced the FCC to do their deregulation bit by bit instead of in big lumps. One of the major problems with this docket was the tying in of killing amplitude modulation with a lot of desirable changes. Amateurs don't like AM much on the low bands, but they are not completely convinced that it should be killed off by fiat. This could prevent experimentation with double sideband techniques, and these hold great promise for better band densities with less interference than anything in view for single sideband. If we can get five times as many stations in a band with less interference than we're suffering with SSB, why should we prohibit experimentation? Synchronous detection may turn out to be one of the great undeveloped fields of amateur radio. Or it may not ... but should we let the FCC halt it?

What can you do about this? You can write a petition to the FCC asking them to honor Special Temporary Authority applications unless there is an *overwhelming* reason for denying them. Demand freedom for amateurs ... with 15 copies ... and an extra one for me. The next time you see your ARRL director or write him, ask that he get the League to work in the same direction ... and make sure he lets you know what is happening.

BASIS AND PURPOSE: THWARTED?

While rereading the FCC regulations for the umpteenth time — it was during some work in cooperation with the FCC on a project to update the ham exams — I got to thinking about the meaning of the first paragraph, 97.1 Basis and Purpose. The language is so muddled and exact interpretation is impossible — a strategem used by government bureaus which permits their continued growth, while providing good flank protection.

The proposed Novice exam material seemed to be a bit scant as far as the basis and purpose of amateur radio was concerned. It had boiled the five parts of 97.1 down to three, so I looked at the rules to see what had been omitted. Two parts had been left out. One turned out to be 97.1e, the enhancement of international goodwill. I was sort of sorry to see that on the way out — perhaps it was an oversight — or maybe it didn't seem all that important anymore to the FCC.

The other omitted part of 97.1 was a legitimate deletion. The actual intent of 97.1 is to define the basis and purposes of the *rules*, not of the amateur service, but since four of the five parts of the paragraph apply to both, 97.1 itself has come to be thought of as being a statement of the basis and purpose of amateur radio. This part is most significant in the light of recent rule changes and proposals for rule changes. 97.1c states that the purpose of the regulations is for the "encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both communication and technical phases of the art."

That seems simple on the face of it. Yet, as the ONLY rule applying solely to the purpose of the rules themselves, it would seem that it should have a binding effect on the Amateur Division of the Commission when they are preparing new regulations for enactment.

The rules then should encourage communications skills and technical developments. On the face of it, this would dictate that new rules should strongly avoid interfering with amateur technical experimentation and pioneering and should be oriented toward encouraging these things. It is fascinating to take a good look at the

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recent major rules changes from this viewpoint.

The "incentive licensing" rules: In what way did they contribute to the advancement of communications or technical pioneering? The taking away of band segments to force amateurs to go back for a new license exam would not seem to be even remotely relevant to either. The Commission apparently got carried away with doing the bidding of the ARRL, even though it was inconsistent with the basic mandate laid down by its own rules.

The repeater docket was most restrictive to those interested in pioneering and technical experimentation. We've been promised that the most severely restrictive aspects of the docket will be modified, but still we had a good example of the Commission going directly against its most basic basis and purpose, as stated in 97.1c.

How about recent dockets? How much of the change proposed in the rules can be justified as being consistent with the mandate of 97.1c? What changes will encourage the development of communications skills? Will any parts of it encourage technical developments or the pioneering of new techniques? Let's really look closely at the dockets with these basic guidelines in mind and include this in our comments we file with the Commission – with 14 copies.

Is the taking away of RTTY and other such privileges from the General class and Tech licensees consistent with 97.1c? Will the goal of having them be relicensed as Advanced or Experimenter class licensees in any way be consistent with 97.1c? It is possible that the Amateur Division of the Commission has gotten its sights askew and is aiming us at some goal not specified by 97.1, and it is difficult to see how forcing us to pass more and more advanced FCC exams for higher classes of license is consistent with any of the parts of 97.1, though it is easy to see how it is quite *inconsistent* with 97.1c.

One of the reasons for proposed rule changes has to do with getting more amateurs. This is a good goal, undoubtedly, but it is in no way consistent with 97.1 – there is nothing whatever in there about getting more amateurs. Another purpose has been to get away from the problems of faked mail order licenses. This, too, is probably a good goal, but difficult to justify under 97.1 . . . particularly since there has been no real evidence that the problems involved are serious enough to warrant an enormous upheaval.

Since 97.1c says the rules should provide for enhancing communications skills, we must ask how putting restrictions on the use of a license work in this direction. The more restrictions there are, the less communications skills are going to be enhanced . . . right?

COMMUNICATIONS SKILLS

What amateur activities are best for developing communications skills? Just about any on-the-air activity, possibly with the exception of plain

old rag chewing, might be considered beneficial in skill developing.

Sending and receiving CW is a skill. Rapid typing on RTTY is a skill. Finding Oscar and making contacts takes skill. Sorting out the pileups to get a rare one on either phone or CW takes a good deal of skill. Contests sort out the unskilled in short order.

What in our recent rule changes has been added which would tend to encourage the development of skills? Do we do better to require someone to take an exam and prove he knows the theory of SSTV before we let him get on the air and operate with it? This is part of what we're doing with Docket 20282, and it seems like nonsense to me.

If we want people to develop skills in working with SSTV, we want to first of all remove as many obstacles as possible that are preventing them from developing these skills. We want to get them on the air with SSTV as quickly as possible, then they'll have the incentive to learn and be in touch with the people who can teach them. I didn't know beans about SSTV when I went on the first time.

I knew even less about RTTY the first time I got on the air on that mode, but my interest was stirred and I soon learned all I could. RTTY was so much fun that I had to know more, to build equipment and to get on more bands. We were stuck up on 2m and 11m in those days and FSK was illegal on the low bands. I got on 80m just sending mark signals and had a ball. We put an RTTY repeater on 2m in 1948.

Communications skills will best be developed, I think, if we keep the restrictions to a minimum and encourage new modes, new ideas, and the fun of it all. One thing is for sure, and I doubt if I will get any disagreement on this: The one single aspect of amateur radio that is just about the *least* fun is taking an FCC exam.

TECHNICAL SKILLS

The more the FCC can do to encourage amateurs to experiment and develop new ideas, the more value the amateur service will have — and this is consistent with 97.1c. Just look at recent technical developments: Amateur pioneers are hard at work with incredible circuits for SSTV, digital timers for Oscar alerts, Morse code to RTTY converters and vice versa, synthesizers for everything, computer applications for amateurs, sophisticated repeater controls — the list is almost endless . . . just look over the articles in *73*.

Instead of making these developments more difficult and hamstringing us (pardon), the FCC should be fanning the flames of interest and enthusiasm. They should be coming out with rules which would continue to remove more and more of the restrictions so we can work with pulse technology — with telemetry — and all the other far out ideas which might prove valuable if pioneered.

We have plenty of band room for new ideas. Why have we been prevented from having repeaters on ten meters when the band is virtually dead? Why are we so restricted on six meters when that band is a wasteland? Look at the restrictions they put on 220 MHz . . . and for what? No sooner did amateur repeater groups agree on standards for repeaters than the FCC shot them down with subband allocations. Insane! Has the FCC *ever* had any success in trying to read its crystal ball? And yet, this is what was going on . . . they divided up a totally unused band on the basis of what might someday happen, provided there were no unforeseen technical developments . . . and that is one thing you can depend on . . . amateurs will come up with unforeseen technical developments.

Just take a look at the 146-148 MHz band . . . in the early 60's that was and had been virtually deserted for almost 20 years. Loud voices were asking that it be turned over to CB. Then came repeaters, and within a few years this unused band had more amateurs using it than any other ham band. Use expanded very rapidly until the FCC got into the act and passed rules which stopped its growth for a while . . . then, after the biggest battle in the history of the hobby, the FCC (Walker) backed down and FM began to grow again.

Let's try and keep the FCC from putting through more and more restrictions which interfere with amateur pioneering and the development of communications skills. Remind them of 97.1c every time they start to make life difficult for us.

CAN HAMS REALLY BE TRUSTED?

Though I know of nothing in the FCC regulations which specifies that amateurs be self-policing, the fact is that we have done a rather good job of this and we accept it as a responsibility . . . some more than others, unfortunately. I would like to see more amateurs be serious about this.

The major growth of FM repeaters on two meters was almost totally without FCC interference. The first reaction of amateurs to mutual repeater interference was one of frustration . . . then repeater wars . . . and finally the development of repeater coordinators and repeater councils. To me this whole thing was an excellent example of the true amateur spirit. Even the hottest of heads eventually were calmed down and brought around to a reasonable and cooperative solution to the problems.

It was this example that was laid before the FCC at the hearing before the Commission in January, 1974 . . . a hearing demanded by the amateurs and ignored by the ARRL. On the strength of this proof of amateur responsibility, the ball was put in motion to deregulate us. This has resulted in a reduction of about 25% of the rules so far, and a lot more deregulation is under consideration. These things are monuments to the trust and foresight of FCC Chairman John Wiley, Charlie Higginbotham and Johnny Johnston.

The repeater problem wasn't the first instance of good amateur cooperation by any means. Whenever emergencies come along, amateurs drop their differences (which are many . . . like any other mixed group) and cooperate. And older timers will remember the "gentleman's agreement" as far as sideband was concerned on twenty meters. With very few exceptions, amateurs turned out to be gentlemen and virtually all sidebanders kept to the high end of the band, with the AM on the lower end of the band . . . and this despite the fact that there was little DX to be worked from the high end . . . it was all on the low end.

It is my impression that amateurs are perfectly capable of making gentlemen's agreements . . . and keeping them. Some of our self-proclaimed policemen aren't as subtle as we might like, but I'd rather have a nerd rattle the chain than no one at all. When you hear things going wrong, for heaven's sake speak up and see if you can pour some oil on troubled waters. It may be a guy with his mike up too high . . . a chap who got his switches backwards and is calling in the DX band and listening in the U.S. band . . . or someone stretching the bounds of decency on any band.

The fact that many amateurs have the feeling that they only have to watch out for FCC monitoring stations does not help matters. The FCC would do us a big favor if they were to announce that they would no longer issue citations for infractions of the rules, for this would forcibly make all amateurs aware that it is the responsibility of every amateur to uphold the honor and reputation of the group. I think we would very quickly be rid of the unspeakable garbage a few 75m AMers are putting out . . . and the disgusting behavior on a few Los Angeles repeaters. Even CBers wouldn't put up with rot like that!

The frequency coordinators for repeaters have been particularly protective of non-repeater interests, oddly enough. Most of them bend over backwards to make sure that repeater groups stay out of the way of all the other users of the VHF bands . . . AM, SSB, RTTY, Oscar, Moonbounce, DXing, meteor scatter, ATV, etc. We seem to be in much better hands when we are governing ourselves than when we are depending on the FCC . . . and the action sure is a lot faster. Many FCC actions are sped along from proposal to rule making in *only* four or five years, while some drag on for eight or ten. This is a real drag for amateur radio, since most of our significant developments sweep in and are accepted by us way before the FCC can get organized to cope with it rulewise.

The FCC reaction to repeaters was a good example of their fast work . . . by the time they got around to screwing up the works (royally), repeaters were too big a deal to get killed off. Obviously the FCC does not read its own rules . . . as I have written earlier . . . where they are supposed to encourage amateurs to pioneer and invent. Even in 97.3a they define the amateur radio service as "a radio communication service of self-training, intercommunication, and technical investigation carried on by amateur radio operators." Note that technical investigation part and ask any old-timer how many times the FCC has done just about everything in its power to stall same.

Amateurs, left to their own ends, might come up with even more fantastic developments than they have already . . . and, in case you've forgotten, chalk up FM, NBFM, SSB, and SSTV (so what else is there?) all to amateur inventing and pioneering. For years the FCC prohibited any amateur transmissions which could not be copied by all FCC monitoring stations . . . how about that for locking the door on developments? If we were permitted to be our own bosses, and I don't mean via ARRL, I think we could set up our own system for coping with the needs of progress . . . and on a speed which would be more geared to reality.

Why did I single out ARRL there? Their record on repeaters is typical . . . and a model of what service we get from them. They tried to ignore FM and repeaters for years . . . then, when it could no longer be ignored, they tried to step in and take control. Their recent ARRL band plan for the repeaters has battles going on all around the country because it is so out of touch with reality. ARRL is great for what it is designed for: radio relays. Their traffic system is fine and a service of which to be proud. Their record in other areas is execrable.

If we can't get quick action from the FCC on our needs . . . and we can't depend on the ARRL, what can we do? To whom can we turn for help?

How about starting with our repeater councils . . . we have them spread all around the country and they are already responsive to the will of the grass roots via representatives from the repeaters they serve. We might set up a yearly meeting (or every other year) where each council would field two representatives to decide upon the "gentlemen's agreements" for the next year or two. This would give us speed and responsiveness. It would keep the cost down, too, since there might be only about forty or so repeater councils involved.

On the other hand we might do better with a week-long national convention where the delegates were sent by interested clubs. This activity could become a major activity of most ham clubs . . . in which case we could have a couple thousand delegates getting into the act . . . probably every two years. That would be a truly democratic system.

When you stop to think about it, a structure starting with the local clubs expressing their views to a council of clubs makes a lot of sense. And a group of 80 delegates might get a lot more work done in a shorter time than 2000. The ITU system of breaking problems into separate committees for discussion gets things done quickly . . . then the committees bring their recommendations to the whole group for ratification.

In order for the actions of a conference such as this to have any validity, we would need a mandate

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BE MY GUEST

visiting views from around the globe

C'mone Texas Salt Rat...

The scene is a Washington cocktail party at the home of an influential congressman. Guests from government and business are milling about, socializing and discussing the issues of the day or whatever. Suddenly the low volume of a local dinner music FM station is shattered by the deafening roar of undemodulated single sideband: "Come on Texas Salt Rat ... this is the Maryland Grease Monkey ... you got a copy?" Two blocks from the congressman's home, a CBer, operating illegally out of band with a broadband linear amplifier, strains his ears against the static, then starts to call again: "C'mone TEXAS. Ya got this here MARYLAND state ... MARYLAND ... MARYLAND ... MARYLAND, C'MONE?"

The cocktail party, by this point, has shifted gears from the issues of the day or whatever to "those damn CBers," or worse, "those damn hams." The congressman, highly irritated, is on the phone by the time our CB friend cranks up the power for call number three, calling an aide to FCC Chairman Richard Wiley. "The folks back home have been writing me about this damn interference," he tells the aide, "and it's high time you guys got over here and did something about it!"

Needless to say, the congressman and a large number of his Capitol Hill colleagues have begun to put the wood to the FCC. When congressmen talk, the FCC listens. And what the FCC has been hearing a great deal of lately are interference complaints. In fact, last April the FCC stopped counting them after passing the 100 thousand mark. The axe is about to fall, and amateurs everywhere better be sure they're not in the way, because it is much later than most of us think.

Meeting room #6 at the Hotel Sahara's Convention Space Center in Las Vegas: Thirty ham radio equipment manufacturers, worried over press reports of an impending linear ban and type certification of ham gear, meet with FCC representative Dick Everett. They learn a proposed rule making is on Chairman Wiley's desk — in general, it would ban the manufacture and sale of linears capable of 24 to 35 MHz operation and force type acceptance. It is the eleventh hour, and ham radio has no lobby in Washington (ARRL can't lobby due to its non-profit status). The organizers of the SAROC meeting (Dentron's Dennis Had and Bob Levine) suggest formation of a manufacturers association, and the group is founded. It's called ARMA, the Amateur Radio Manufacturers Association.

ARMA was formed to encourage high standards and ethics in the ham radio industry, to promote the general growth and welfare of amateur radio, to work toward favorable rule making and legislation for the benefit of amateur radio, to function as liaison between the manufacturers and the FCC, to encourage public relations functions for the industry, and to collect and disseminate market information to the members. Two classes of membership were set up: full membership for domestic manufacturers and importers, and associate membership for publishing organizations, dealers, and other interested parties. The list of organizers reads like a "who's who" of the ham radio business.

The week after Las Vegas, ARMA sent a four man committee to Washington. They were able to see several FCC Commissioners, Senator Barry Goldwater, FCC Chief Engineer Ray Spence, and Enforcement Chief Richard Smith. One of the committee members, Marv Druskoff (VHF Engineering), described their greeting at FCC headquarters this way: "They wanted to know where we'd been, where we were when they needed us." The committee learned that the linear ban proposal had been written by two FCC staffers, without the benefit of outside ham help. Few specifics could be learned about the proposal because it had gone so far along in the FCC hopper, rushed through, in fact, in face of increasing complaints from Capitol Hill and pressure from the all-powerful broadcasting lobby. The broadcasters, ARMA learned, were worried about lost revenue as TV viewers switched to channels not affected by the CB interference. The TV lobby, Senator Barry Goldwater K7UGA told the committee, is so strong that it has twice managed rejection of his bills aimed at forcing built-in high pass filters and better shielding of TV receivers. Senator Goldwater assured the ARMA committee he'd try again, and support them in every way possible.

Back at the FCC, the committee members were hard at work trying to win delay of the linear amplifier ban, in hopes of suggesting engineering solutions. "We're working on the idea of pre-filtering with an 8 pole filter to eliminate 27 MHz," says Dentron's Dennis Had. "If disconnected it would have to totally disable the amplifier, because the FCC won't stand for any more easily clipped jumper wires." At deadline, engineers in Ohio, Pennsylvania, and California were working on such a system, along with several other ideas, but the question of a delay rested with the full FCC, which was scheduled to meet on the subject January 26th.

In Had's words, "We told them they'd waited two years, so why not put it off another 45 days?" ARMA was also working on point of sale control to prevent non-licensed people from buying equipment. Had says such controls would have to have regulatory backing to avoid problems with the Federal Trade Commission. (The manufacturers, by refusing to sell gear to offending dealers, could open themselves to legal action without federal backing.) Had told *73* he was optimistic, but realistic, on delaying the linear ban. As he put it, "It may have gone too far before we got there."

At best then, the notice of proposed rule making on the linear ban may turn out to be more general then it would have been if ARMA didn't get to the FCC when it did. The rub is that the manufacturers are afraid the FCC will bow to the Capitol Hill and broadcasting industry pressure ... and make a move designed to be expedient, a move that could really hurt ham radio in the future. That, by every measure we could find in preparing this report, is not the FCC's intention. As one member of the ARMA committee put it, "They've got a problem and they need a solution ... and they don't want to cripple the hams in solving it."

At the root of the interference problem is the FCC's placement of CB on the 11m band. It made it all too easy for amateur equipment to be used on CB, and the amazing growth of outlaw activity and the TVI-RFI problem is the result. ARMA members were told by high-placed FCC officials that the mistake would never happen again. Manufacturers have played their part as well. The smell of easy money has impaired the judgment of more than one company. The FCC, *73* has learned, has a list of the "pirate" manufacturers, but cannot stop them from making broadband amplifiers of questionable quality under the guise of 80 through 10 meter coverage. The "catch 22" is a loophole in the FCC's ban on broadband amps to allow for amateur coverage of 10 meters. Of course the quick buck manufacturers got around it by including band-switching for 80 through 10 meters, switching that in most cases only cut power output down on all bands but 27 MHz! FCC tests have shown some pretty questionable engineering on the broadband amps, like tricks to build up forward power on built-in swr bridges (in one case pure ac was coupled into the circuit!). Another FCC amplifier test reportedly found power output in excess of 300 Watts, but when a 27 MHz filter was put across the output, the rf at 27 MHz was down to about 40 Watts! (It's not hard to understand where all those TVI complaints are coming from, is it?) The thing that really hurts on the FCC end is the placement of advertising (in *other* ham magazines) for these bootleg linears. In the absence of a viable ham radio lobby (like ARMA), the FCC really didn't have much choice but to plug the loophole, to ban linear amplifiers capable of 11 meters.

By the time this issue reaches you, a rule making proposal will probably be public. It could mean legitimate amateur amplifiers will stop at 15m, or traps will be built in to prevent operation on 11m. It will *not* stop hams from home brewing their own 10 meter amplifiers, and it won't outlaw existing equipment. It *will* require type certification of commercial amateur equipment, a burden the manufacturers have assumed for some time was on the way.

Okay, you're saying, a ban on newly manufactured linears covering 11m won't clear up the TVI mess ... and you're right. But it will, argue FCC staffers, stunt the growth of out of band activity and power amps on the regular CB channels. The second step is education, using the same approach that's worked with ham radio — peer pressure and self-regulation. It may not be long before TV commercials and magazine ads begin pushing *legal* CB operation. Maybe a "Smokey the Bear" character warning CBers that the guys running amplifiers are only hurting everybody else since they mop up several channels at a time.

Another thing: A lot of the out of banders (and regular CBers as well) think of themselves as hams. They use a peculiar mix of ham and CB jargon in a format typical of our beloved (and often boring) QSO. When blindfolded, most of us would swear we were listening to 75m if it wasn't for an occasional "mercy sakes" or "come

on back." Listen for yourself both above and below the 11m band . . . the typical SSB QSO covers the weather, equipment, antennas . . . and sometimes several thousand miles. We still don't know if it was a joke or what, but the Post Office recently delivered a *Swiss* CB QSL addressed to a Peterborough CBer! (We still haven't found the CBer . . .)

Fact is, it's those guys, with stations rivaling many amateur installations, who are the prime candidates for ham radio. Reaching them is the problem. The best way to do it is on the local level — include a welcome to CBers at your next auction or hamfest. Be sure all PR mentions a *local* address or phone number to find out more about ham radio. And don't forget the shopping centers — a good exhibit and a few friendly club members can go a long way. Another idea is to hand out back issues of your favorite ham magazine (and copies of the other ones, too). A lot of hams are doing it already, but I haven't heard of any clubs distributing magazines — if there are any interested, drop me a line.

So, in the midst of proposed bans on linear amplifiers above 24 MHz, type acceptance of ham gear, strong growth in the amateur ranks, and 40 channel CB, what's the future of ham radio? It *has* to be positive.

For one thing, there are the FCC assurances that CB allocations and ham bands will never be placed near enough together to cause the kind of problems we've seen on 11 meters. That's led to several sighs of relief regarding 220 MHz and Class E. (As reported last month, ARRL hopes to swap the 900 MHz WARC allocation for CB allocations at 220 MHz.) We've also heard of tests going on to determine how useful 900 MHz would be for CB, with interesting results. There is, of course, no skip, and coverage seems comparable to 27 MHz. It's only logical to see 900 MHz CB repeaters, complete with autopatch, in the future.

But what about 10 meters? Indications are that the loss of newly manufactured commercial amplifiers for 10m will not slow the band's growth. 28 MHz, according to sources both in industry and government, would have been opened to a new class of licensees months ago, if it wasn't for the tremendous volume of CB and ham applications coming into the Gettysburg computer facility. It all begins to fit together: multiple choice code exams, expansion of Technician and Novice class privileges, the dropping of "N" prefixes for Novices . . . the Communicator class is just around the corner, and it looks like 10m will be added to the previously discussed 220 MHz allocation for Communicators. (In the same vein, the FCC would probably consider granting Technicians equal status on 10m.)

The implications of all this for ham radio are unclear. For one thing, there are too many variables to be sure Communicator class licenses will become a reality in the near future. For another, we don't know whether the 220 MHz for 900 MHz swap with the CB interests will work (that largely depends on those 900 MHz tests we mentioned). There is also the question of WARC, and the international situation (see *73* Special Report, February, 1977). The best assessment is probably Dennis Had's: "I'm optimistic but realistic." That's a good attitude for all of us.

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RFI/TVI - An Analysis

Radio frequency and electromagnetic interference from a phenomenally growing number of sources, such as CB sets, consumer electronic devices, video games, computers, switching power supplies, ignition systems, and industrial, scientific, and medical equipment, has reached proportions beyond the effective control of the understaffed Federal Communications Commission.

The majority of complaints (87%) of interference to home electronic entertainment equipment involve CB transceivers. CB units have interfered with nearly every mobile and fixed communication service, including business, industrial, law enforcement, utilities, aircraft, and other public safety devices.

However, CB is not the only culprit, as garage-door-opener transmitters, industrial rf heating, medical diathermy equipment, community antenna television systems, super power FM stations, and auto ignition systems contribute their share of RFI. Compounding the RFI/EMI problem for the FCC is the appearance of millions of potential sources of interference from consumer devices such as video games, computers, switching power supplies, etc.

To combat this problem, the FCC has taken two steps, the first being the adoption of stricter regulations for RFI emitters like CB equipment. Also, the FCC has proposed revisions which will strengthen two crucial sections of its regulations, Parts 18 and 15. The former regulates industrial, scientific, and medical equipment, while the latter covers devices with low power intentional radiation, such as wireless intercoms, and devices with unintentional radiation, such as electronic games.

Historically, the FCC has considered the emitters of interfering radiation the villain, but with emitters growing by the millions, it is now considering imposition of regulations requiring the manufacturers of consumer entertainment electronic equipment to make their products RFI/EMI proof. At present, the FCC has no legal authority to do this, but an amendment to Section 302 of the Communications Act would rectify this.

At present the harmonic suppression requirement for CB transmitters is -60 dB below the carrier. The CB manufacturers claim that this amount of suppression in a legally operated transmitter will not cause RFI to TV sets, and when it does happen, it is the fault of the wide-open front end of the TV set. However, Joseph DeMarinis, director of engineering for GTE Sylvania, disagrees. He states: "The filtering and shielding of a TV set is an order of magnitude, or more, better than the state of the art of CB transmitters."

Less known is the fact that the radiation from oscillators of CB receivers has been creating interference problems for three public services: the Power Radio Service used by electric, gas, water and steam utilities in the 37 MHz band; the aircraft services band, 100 to 135 MHz; and the Forestry Conservation Service operating on 151.205 and 151.400 MHz.

Interference to Power Radio Services stems from the heterodyne type of frequency synthesis used by many 23-channel CB transceivers. To minimize the number of crystals, the 23 oscillator frequencies are obtained by heterodyning the outputs of two oscillators. One uses crystals at 37.6, 37.65, 37.7, 37.75, 37.8, and 37.85 MHz. The other has crystals at 10.180, 10.170, 10.160, and 10.140 MHz for a combined total of 23 channels.

The 37.6, 37.7, and 37.8 MHz frequencies happen to be those used by the Power Radio Service. To alleviate interference of all three services, the FCC amended Part 15C by adding a new Section 15.59 that requires the certification of CB receivers to new low limits of oscillator radiation. The manufacture of CB receivers not certified to meet the new requirements must cease no later than Aug. 1, 1977.

Illegal or bootleg rf amplifiers increase the CB transmitter many times its legal 4 Watt limit. These amplifiers are made available to CBers by a few irresponsible CB suppliers who manufacture amplifiers, ostensibly for amateur use, but which can be driven by only 3 or 4 Watts. As most amateurs have exciters with about 100 Watt capability, the subterfuge is quite obvious.

To help combat bootleg activities and other sources of CB interference, the FCC's Field Operations Bureau is investigating a random selection of TV interference complaints. It is engaged in the following activities:

1. Monitoring a CB station unannounced to determine if a linear amplifier or other illegal accessory, such as a VFO or power mike, is used.

2. Inspecting CB station equipment for spurious emissions through the use of spectrum analyzers.

3. Inspecting a complainant's TV receiver for received signals and antenna quality.

4. Installing high pass filters on the TV receiver and low pass filters on the offending CB set.

5. Making a neighborhood survey to determine the impact of interference on the local area around a CB set.

Most of the FCC regulations governing consumer electronics devices and equipment appear in Parts 15 and 18 of the Commission's rules, but Part 15 has not been amended since 1948, and the basic technical specs of Part 18 have remained the same since 1946.

Since then, however, vast technological advances have occurred. Semiconductors, integrated circuits, and digital systems have appeared. Many new devices operating at frequencies substantially higher than in the late 40's present new interference problems.

Consequently, the FCC has proposed overdue changes to Parts 15 and 18. One proposed change in Part 15 is the certification of restricted-radiation devices such as electronic (coin operated) games that use rf energy, rf switching supplies operating above 10 MHz, wireless intercoms, etc. Other devices will be added to the list as the need arises.

A real headache for the FCC is the TV game that can be connected to the antenna terminals of the owner's set. "These games are potentially as popular as CB sets," says Milton Mobley, chief engineer in charge of the FCC's testing laboratory in Maryland. "We've had more applications for TV game type approval in the second quarter of '76 than we had in the past four years . . ."

A number of interference sources producing random broadband electrical noise can be just as disruptive to communications as the narrow band emitters, such as CB sets. As yet, these devices are unregulated by the Commission. However, complaints from these products have increased.

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Continued

A New Repeater Era?

Can you imagine walking around town with an HT and talking to the world on 20 meters? Or talking to Japan when propagation conditions are mediocre? All that and *much* more may be possible if Docket 21033 goes into effect. The notice of inquiry and proposed rule making would profoundly shake up the existing system of repeater licensing and operation.

That bombshell was released early in January by the FCC. As the Commission puts it, "Our experience has demonstrated that amateur radio operators are fully capable of developing and operating complex systems of stations with a minimum of regulation by the Commission. We are aware of no compelling reason why amateurs wishing to operate repeater, auxiliary, control, or remotely controlled stations should continue to be required to obtain Commission permission before beginning such operation."

The FCC then goes on to propose that all repeater licenses be eliminated altogether. *Any* amateur would be allowed to set up a repeater *without* the need for FCC permission.

But that is not all. The docket proposes that deregulation of repeater stations continue with deletion of the requirement that all open repeaters be monitored by control stations in real time or be recorded. Logging requirements would be changed so that rather than authorized control points, the names and addresses of control operators would be listed in the log.

So what? That might create a bit more confusion on 2 meters. The biggest shock comes in paragraph 12 of 21033. Again, quoting the FCC, "It appears that many amateur operators seek greater flexibility in the choice of frequencies for repeater operation. We are therefore proposing to permit repeater operation on *all* frequencies allocated to the Amateur Radio Service, except 435 to 438 MHz." Completely unexpected, that part of 21033 seems to be the biggest surprise out of Washington in quite a while. The implications, should the docket be adopted, are enormous.

73 contacted several frequency coordinators and other amateurs and asked for their initial reactions to the proposal. The majority of answers were negative, ranging from mild dislike to utter consternation. In general, the feeling seems prevalent that near utter chaos will result from complete repeater deregulation. Those involved with frequency coordination were the most vehemently opposed, saying frequency coordination is difficult enough at the present time.

It's evident that with the ever-increasing headache of CB and the attendant enforcement and paperwork problems that are being created, the FCC is anxious to ease their workload in amateur areas. The paragraph about amateurs being able to operate with a minimum of regulation is one that all hams can be proud of. Coming from a government bureaucracy, it becomes even more amazing.

The problem is, with the number of hams increasing, how long can we continue our self-regulation? With increasing numbers come increasing problems. Witness "Repeater Appreciation Week" on the West Coast and the "Ohio RTTY War" (see *Briefs*). Suddenly, operators who feel they have a "right" to a frequency and increasing congestion on repeaters are creating bad feelings and hardening attitudes.

It seems that the FCC's proposal would create, if not chaos, a good bit of confusion and disorder on the ham bands. The FCC says that part 97.63 would be revised to "emphasize the two principles which have made possible the efficient operation of many amateur radio stations in relatively small spectrum space, namely, that a station using a frequency has first priority in such use over other stations and that all frequencies allocated to the Amateur Service are shared on a non-exclusive basis. It is presently the responsibility of amateur licensees to strike an appropriate balance between these principles to ensure the fair and efficient use of available spectrum." The existing rules say that if a repeater channel is being used for simplex operation, the control operator is not supposed to allow the repeater to be turned on. How often is this the case? The Commission further recognizes that increased congestion might result, and goes on to say that at the present time, they have no specific recommendations to make regarding coordination. They do, however, solicit comments in that area.

The appeal of a 2 meter to 15 meter repeater or any of the numerous possibilities is too great to dismiss. Perhaps a mandatory system of frequency coordination will have to be instituted. *73* is currently surveying the comparative success and failure of coordination. Look for a special report on the subject in next month's issue.

April 1 is the deadline for comments on Docket 21033. They may be sent to Federal Communications Commission, 1919 M St., NW, Washington DC 20554.

Stan Miastkowski WA1UMV
Associate Editor

CB and the ARRL

A scenario has become clear regarding ham radio, CB, and the ARRL. Some clues from X-MITTER, *Journal of the Penn Wireless Association, Bristol PA:*

We are grateful for having had Chod Harris WB2CHO as our speaker at our twelfth annual awards banquet on the 13th November. Chod is an excellent speaker, and presented an important message.

Chod is running the newest ARRL department: Clubs and Training. His most important responsibility right now is assisting as best possible the recruitment and training of new amateurs — these times being the best ever for the expansion of amateur radio. He, presumably in concert with others of the HQ staff and the Directorate, obviously has studied at length the varied avenues possible, and is directing the League's major effort to presenting our story to those who have tried casual and hobby-type operating on the Citizens Service and have found it unsuitable for such use (as FCC intended).

His presentation to Penn Wireless touched only briefly on the training aspect, however. His message was that of top level cooperation between the two services, lumping them (correctly) as "personal communications" wherein one group has tremendous numbers and practically no expertise, and the other, with comparatively low numbers, has technical abilities fully in line with the state of the art. Personal communication in general having need of overpowering numbers and the ultimate in technical abilities, the combination should be irresistible while individually both could founder.

What are the situations to which this might apply? Many exist — they can be left to the imagination. Several were discussed at the banquet both in Chod's formal presentation and in the open discussions following. Local level legislation, for one. Tower ordinances are literally flying around the country; many are very poorly drawn. There is even some attempt to legislate RFI! RFI is an extreme problem. Our BCI and TVI problems of 10 and 20 years ago seemed bad at the time, but those of today are orders of greater magnitude. Emergency communications practices — they're always needed. Competition with other services, both domestic and international, is a continual problem, coming to a periodic head with the 1979 WARC.

All of these problem areas and more can be handled best with numbers (which CB can provide) and the ultimate in technical abilities (which we have). Thus, the times demand that we seek out the CB users to offer our complete cooperation. Why not the other way around? Because there is not (and likely will never be) any centralized CB organization in any way comparable to our ARRL and IARU. The service simply is not adaptable to any such centralization any more than there could be a central organization of telephone users. An ATT and an FCC, perhaps, but of users?

What is evolving is the stabilization of the two services. Those who would have radio for learning about electronics and radio will ultimately be licensed amateurs; those who need radio — for whom the wired telephone is insufficient — will be CB equipped. And probably this latter group will include most of the mobile portion of our population, for business communications are really desirable for most of us. The enforcement problem will never disappear, but it's conceivable that as the hobbyists leave the Citizens Service for amateur radio, the CB enforcement will become practical.

This is the goal which ARRL is aiming for. The tiny group in Newington can't do it alone. They can only help coordinate a flexible program and rely on us as scattered clubs and individual responsible amateurs to implement it. But the way Chod put it to us, it is not only mandatory to the long term welfare of amateur radio, but it's already started. The future of amateur radio looks good. Our 1976 facilities exceed anything imagined in 1956. It's predicted we won't need another 20 years to see equal advancement and expansion.

Updating WARC

Opposition to FCC WARC proposals for 15m and the lack of additional ham bands at 10, 18, and 24 MHz are prime ARRL reactions to docket 20271 (see Special Report, 73, February, 1977). Following is part of a letter to affiliated clubs and League Directors issued the week after FCC publication of the proposed US WARC position.

"We urge you to study this carefully and to file comments with FCC. This is one of the most important documents on amateur radio that you will see in this decade, and it is imperative that the Amateur Radio Service make its voice known in these proceedings.

"There are three broad areas where we believe comment will be beneficial. First, where we agree with the position taken by the Commission, we should comment favorably and reinforce their action. This is necessary because undoubtedly other services will be unhappy with some of the gains registered by the amateur service and will seek to have those positions modified. Thus, we must be sure to support the Commission in those actions they have taken in favor of the amateur service. For example, the FCC has proposed the creation of a new amateur band at 160-190 kHz, it has proposed an exclusive amateur band at 1800-1900 kHz and a shared amateur band from 1750-1800 kHz, it proposes the continuance of the 3500-4000 kHz band making 400 kHz exclusive in place of the present sharing arrangement, it proposes expanded bands at 6950-7300 and 13950-14400 kHz, and our bands at 28 MHz and the VHF/UHF are maintained. These are positive actions to comment on favorably.

"Second, we believe that adverse comment is required concerning the proposed change at 21 MHz. The Commission has shifted that amateur band from 21000-21450 to 20700-21200. Admittedly, this is a gain of 50 kHz, but it would come at the expense of considerable modification and replacement of existing amateur equipment. The Commission stated that the shift in the band was necessitated in order to accommodate certain requirements of the maritime mobile service. However, the League staff believes that with a slight rearrangement of the various allocations in the vicinity of 21 MHz, the martime mobile requirements can be met and the amateur bank 2100-21450 need not be shifted.

"Third, we believe that our original request for new bands at 10, 18 and 24 MHz was entirely justified, and has not been given adequate attention. In particular, a new band at 10 MHz, even a narrow one, would permit improved communication between amateurs in all parts of the world at those times when the maximum usable frequency does not reach 14 MHz. At the present time, such communications must be conducted at 7 MHz, a circumstance which requires the use of greater transmitter power because of increased absorption and interference from the Broadcast Service. New bands at 18 and 24 MHz would serve similar purposes."

At deadline, the word from Washington sources was 15m could be solved, but new ham bands at 10, 18, and 24 MHz seem unlikely. More next month.

Warren Elly WA1GUD
Associate Editor

Breaker, Breaker, Six...

A large volume of our mail continues to focus on theft . . . and here's one of the better ones, courtesy of the Minuteman Repeater Association Bulletin, Lexington MA. Jack W1DXQ and Murry K1GGP tell how an "MMRA Soft Sell," follow-up, and just plain cool help recover a stolen rig.

One afternoon in October, W1DXQ and K1GGP were in QSO during DXQ's "long" ride home from work. During our QSO, we heard a rather odd break station.

"Breaker six."

Our first thought was ignore him and he might go away.

"Breaker six."

Well, guess he won't go away; maybe we can scare him away. We stood by for the break station, and the conversation went like this:

Good Guy: Go ahead, breaker.

Bad Guy: Hey there, good buddy, is this channel six?

Good Guy: No sir, this is not channel six. You are operating on the two meter ham band. This is not the CB band. It appears that you don't know that you have a ham radio there.

Bad Guy: Oh, OK, good buddy, just doing some work on this here radio for a friend of mine. Trying to find out how this mobile telephone works.

Good Guy: Well, first of all, you do have a very good signal. However, you cannot operate unless you have a ham license. If you're working on the radio for a friend, he must be a ham and would do his own. If you or he thinks it's a CB radio, it must be a hot radio, and you must have a second class or better to do service work on CB equipment. By the way, what's your handle?

Bad Guy: Handle here is Rick. I didn't know about the license stuff.

Good Guy: Well, Rick, I would suggest that you cease operation of that equipment because you don't have a proper license. (Now for a big scare:) The Federal Communications Commission and other federal agencies frown on such activities. By the way, Rick, the handle here is Jack. You are giving us such a good signal, I wonder, what's your 10-20?

Bad Guy: OK, Jack, 10-20 here is Hanover.

K1GGP overriding "Bad Guy": Hey — I know of equipment that was stolen at the Hanover Mall.

Bad Guy continues: Well, thanks for the information, Jack. I had better get out of here now.

Good Guy: OK, Rick, it is a good idea that you do that. You will save yourself a lot of grief. The repeater would be shut off anyway if you continued to transmit. I'd like to give you more information on this subject, Rick. Do you have a telephone number that I can reach you at?

Bad Guy: Ya, sure, Jack. You can get me at 826-XXXX; got it?

Good Guy: OK, Fine, Rick. I have it and I'll give you a call later.

Well, the "Bad Guy" went away, and Murry and I carried on for a short time, making few comments on the incident.

After I arrived at home, I thought, what the heck, I'll give the guy a call. I know it's a phony number. He was a dummy, but the odds are that he wouldn't be stupid enough to give me a valid telephone number. I called and sure enough, he now qualified as "dummy of the year."

Good Guy: Hi Rick, this is Jack.

Bad Guy: Hi Jack, glad you called. (Gads, super dummy!)

Well, at least he told the truth about the telephone number . . .

Good Guy: I think you should get rid of that radio, as your friend appears to be the owner of a hot radio. What is your friend's name?

Bad Guy: Well, he is not my friend; he is a friend of a friend. I don't know his name.

Good Guy: Well, Rick, I would suggest that you get his name, or at least his plate number and a good description. When the FCC makes their investigation, they won't accept answers like that. (There — that line of bull should throw the fear of God into him — last we'll ever hear him on two meters.)

Bad Guy: OK, Jack, I'll give it back; he is getting me in trouble.

Good Guy: Well, Rick, you just tell the truth when the investigation comes about and you might not be in such trouble.

After the telephone conversation, I figured that just about all that could be done, had been done. To present such information to a local police department, or even the FCC, would be a waste of everyone's time. No real facts or names. Just a telephone number. During both the radio conversation and telephone conversation, the "Bad Guy" did mention that the radio was a Heathkit. I thought of the many rigs that had been stolen in the area, but I had knowledge of only one "Grief-Kit." I recalled that WA1QPL (Dave) had a Heath stolen several months prior. Murry verified that fact, but the chances of this being Dave's rig was a million to one shot.

With the 07/67 grapevine at work, Dave gave me a call after hearing of the incident. He mentioned his stolen rig taken eight months prior from his car in Milton. Well, as far as I was concerned, a Hanover thief would not go to Milton to steal a radio. Make odds now two million to one. Dave was quite interested in a follow-up to the Hanover police. I attempted to soften the blow. I have been through local police and, in most cases, they are too busy to be bothered, or in some cases, could care less. It appears I was wrong. Dave contacted Hanover and gave them what information he

Continued on page 170

Editor:
Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CONTESTS

SOUTH DAKOTA STATE QSO PARTY
Starts: 0000 GMT March 13
Ends: 2359 GMT March 14

The contest is sponsored by the Prairie Dog Amateur Radio Club. The same station can be worked on different bands, modes, and counties for multipliers.

EXCHANGE:

SD stations give RS(T) and county; others send RS(T) and state, province, or country. No SD to SD contacts!

FREQUENCIES:

Phone — 1.975, 3.920, 7.230, 14.280, 21.380, 28.510.

CW — 70 kHz up from bottom.

Novices — middle of band.

SCORING:

SD stations multiply number of contacts times number of states, provinces, and countries. Others multiply number of contacts (with SDs) times number of counties.

ENTRIES:

Certificates to each section. Send logs by April 1st to: WBØEVQ, Box 493, Springfield SD 57062.

CQ WORLDWIDE WPX SSB CONTEST
Starts: 0000 GMT Saturday, March 26
Ends: 2400 GMT Sunday, March 27

Only 30 hours of the 48 hour contest period permitted for single operator stations. The 18 hours off may be taken in up to 5 periods during the contest, but must be clearly indicated in the log. Multi-operator stations may operate the entire 48 hours. All bands, 1.8 to 28 MHz, may be used, but all QSOs must be 2xSSB only.

ENTRY CLASSES:

Single operator, all band or single band; multi-operator (all band only), single or multi-transmitter; multi-operator, multi-transmitter only allowed one signal per band.

EXCHANGE:

RS and 3 digit progressive QSO number starting at 001; use 4 digit number over 1000; multi-transmitter stations use separate numbers for each band.

POINTS:

QSOs with stations on different continent — 3 points on 14 to 28 MHz, 6 points on 7 to 1.8 MHz. Contacts between North American countries (not your own) count 2 points on 14 to 28 MHz, 4 points on 1.8 to 7 MHz. Contacts between stations in the same continent but not in same country count 1 point on 14 to 28 MHz, 2 points on 1.8 to 7 MHz. Contacts between stations in the same country count only for multipliers, not for QSO points.

MULTIPLIER:

The multiplier is the total number of different prefixes worked regardless of band. Each prefix may be counted only once.

SCORING:

Single op, all band and multi-operated stations — total number of QSO points from all bands times the total multiplier. Single op, single band — total number of QSO points from that band times the multiplier. NOTE: A station may be worked once on each band for QSO points, but the prefix multiplier is only counted once.

AWARDS:

Certificates will be awarded in each category in each country, and each call area in US, Canada, and Australia. Other special awards and trophies will be awarded as listed in *CQ Magazine*. To be eligible for awards, single operator stations must work a minimum of 12 hours; multi-operator stations must work a minimum of 24 hours.

LOGS:

Show all times in GMT; use a separate sheet for each band. Prefix multipliers should be entered only the first time they are contacted. Logs should be checked for duplicate QSOs and prefix multipliers. It is recommended that you use a prefix check sheet and include it with your entry. Each entry must be accompanied by a summary sheet listing all scoring information, category, and your name and mailing address in block letters. Also, a signed declaration that all contest rules and regulations for amateur radio in your country have been observed should be included. Official logs and summary sheets are available from *CQ Magazine*. Send a large self-addressed envelope with sufficient return postage or IRCs to: CQ WW WPX SSB Contest Committee, 14 Vandeventer Avenue, Port Washington, LI, NY 11050. All entries should be postmarked no later than May 1 and addressed to the address shown above. The deadlines will be made more flexible in rare isolated areas.

Please check the January issue of CQ Magazine *for complete rules and changes made at the last minute.*

BARTG SPRING RTTY CONTEST
Starts: 0200 GMT Saturday, March 26
Ends: 0200 GMT Monday, March 28

Only 30 hours of the total 48 hour contest period may be operated. The 18 hour rest period can be taken at any time, but off periods may not be less than 3 hours at a time. Times on and off the air must be summarized on the log and score sheets. There will be separate categories for multi-operator and SWLs. Use all amateur bands from 3.5 to 28 MHz. Stations may not be contacted more than once on any one band. In addition to the ARRL country list, each W/K and VE/VO call area will be counted as a separate country.

EXCHANGE:

Time in GMT, must be a full 4 figure group — use of "same" or "same as yours" will not be permitted. RST and message number. Message number must consist of a 3 figure group starting with 001 for the first contact.

POINTS:

All 2-way RTTY contacts with stations within one's own country will count 2 points. All 2-way RTTY contacts with stations outside one's own country will count 10 points. All stations will receive a bonus of 200 points per country worked including their own. NOTE: Any one country may be counted again if worked on another band, but continents are counted only once.

SCORING:

The total score is the sum of (the 2-way exchange points times the number of countries worked) plus (the number of countries worked times the country bonus points times the number of continents).

LOGS & SCORE SHEETS:

Use one log sheet for each band and indicate any rest periods. Logs must contain: date and time in GMT, call-sign of station worked, RST report and message number sent, RST report and message number received, and exchange points claimed. The judges' decision will be final. Send contest logs to: Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex, England EN1 4DX.

AWARDS:

Certificates will be awarded to the leading stations in each class and to the top stations in each continent and each W/K VE/VO call area. The final positions in the Results Table will be valid for entry in the "World Champion of RTTY" Championship.

If any contestant contacts 25 or more different countries (W/K VE/VO call areas do not count as separate countries for award) on 2-way RTTY during this contest, a claim may be made for the QUARTER CENTURY AWARD issued by the British Amateur Radio Teleprinter Group and for which a charge of $2.00 or 8 IRCs is made. Make your claim at the same time as you send in a contest log. Holders of existing QCA Awards will automatically have any new additional countries added to their records.

If any contestant contacts stations on 2-way RTTY with all six continents and the BARTG Contest Manager receives contest logs from the operators in those six continents, a claim may be made for the WAC Award issued by the RTTY Journal. The necessary information will be sent on to the RTTY Journal who will issue the WAC Award free of charge.

WISCONSIN STATE QSO PARTY
Starts: 0000 GMT Sunday, April 4, 1977
Ends: 0000 GMT Monday April 5, 1977

This annual event is jointly sponsored this year by the Neenah-Menasha Amateur Radio Club and the Yellow Thunder Amateur Radio Club. Phone and CW are considered separate bands. The same station may be worked once each band, county and mode. Wisconsin stations may work other Wisconsin stations for QSO and multiplier credit. No contacts can be counted if made on Wisconsin nets while in session or if made through repeaters except for OSCAR. Multi-county portable/mobile operations can be worked in each county they operate from.

Continued on page 42

CALENDAR

Mar 5 - 6*	ARRL DX Contest — Phone
Mar 5 - 6*	YLRL YL-OM Contest — CW
Mar 13	South Dakota QSO Party
Mar 19 - 20*	ARRL DX Contest — CW
Mar 26 - 27	CQ Worldwide WPX SSB Contest
Mar 26 - 28	BARTG Spring RTTY Contest
Apr 2 - 3	Tennessee QSO Party
Apr 12 - 13	YLRL DX-YL to Stateside YL Contest — CW
Apr 16 - 17	CD Party — CW
Apr 23 - 24	CD Party — Phone
Apr 26 - 27	YLRL DX-YL to Stateside YL Contest — Phone
Apr 30 - May 2	Connecticut QSO Party
June 11 - 12	ARRL VHF QSO Party
June 18 - 19	West Virginia QSO Party
June 25 - 26	ARRL Field Day
July 2 - 3	QRP — Summer — Contest
July 4	ARRL Straight Key Night
July 9 - 10	ARRL Bicentennial Celebration Plus One
Aug 20 - 21	New Jersey QSO Party
Sept 10 - 11	VHF QSO Party

*Described in last issue

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Expiration date_____
Signature_____

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Address_____
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LETTERS

CAN SOMETHING BE DONE?

Gentlemen:

I am writing this letter to inform you and fellow amateurs of my recent experiences with and the apparent "fraud" of Trigger Electronics of 7361 North Avenue, River Forest, Illinois 60305.

Enclosed you will find a copy of the letter I have sent to the Illinois Attorney General's Office concerning Mr. Treger's so-called business. I hope you will make this information available for those who read your publication. Hopefully, this will stop many people from making the mistake of placing an order with Trigger Electronics, as I have done.

Anyone interested in information about Trigger Electronics or the appearance of the store itself in River Forest, please feel free to contact me.

David B. Hasenick WD8BNS
8369 Ferris Road
Springport MI 49284
Phone: (517) 857-2385

On October 8, 1976, I ordered from Trigger Electronics, River Forest, Illinois, merchandise amounting to $177.93 by a mail order. I sent a postal money order in like amount to pay in full the amount of my order, copy attached of postal money order #21602081193.

After much time had gone by and I had not even received an acknowledgement of my order, I made several telephone calls to Trigger to see what had happened to my order. Some of the phone calls were by date and amount as follows: October 27, $1.60; November 3, $1.02; November 9, $1.31; November 17, $1.42; November 27, $1.08. At those times I was told that the order was still being processed, but that they had no record of any orders being sent until 30 days after the order was received there. This didn't exactly make sense, but it was their reply.

During this time, a small amount of merchandise from my order was received by me in the amount of $20.41, leaving the balance of $157.52 for a large antenna.

After many of these fruitless telephone calls, we drove to Chicago on December 8, 1976, to Trigger Electronics. The woman that met us in the front office gave the same story as we had received over the phone — that there was no shipping department there, that it was elsewhere and she did not know the location or telephone number of such a department, etc. In looking over in back of the office area, it looked like what shipping was done was one package with dust on it that looked like a "front" and had been lying there for ages waiting to be "shipped." There were stacks of orders lying around with envelopes open and papers still in envelopes. She then told us that no one else was there, but we saw others in the back and asked about this. We were told that everyone was indeed out to lunch and might not be back all afternoon when we pressed her. We then told her we would wait until they arrived. When we persisted, Mrs. Treger came running out from in back screaming that she would call the police if we didn't leave the premises right away. She made this phone call (or what was supposed to be a phone call) to the police, but we waited and no one showed up from this "call." We told her that we were there to settle this account and that we did not drive 200 miles one way for nothing. Finally one of us left to call the police ourselves while the other stayed. Then Mr. Treger showed up from hiding in back and said he was going to beat me up if I didn't leave. He was screaming with fists clenched and would not begin to talk any business, just told me to get out or else he would get me out with a shotgun. When I did not leave, then he did come out with a gun. I did depart and went to the River Forest police station. We went over the entire situation with Sgt. George Straugh, who said his hands were tied unless Treger actually assaulted or shot us. They were as helpful as they could be and suggested we write your office with complete details on this experience.

Now how can any business be left to operate when they only pocket the money and do not ship ordered and paid merchandise? Where are the laws that protect the individual from losses like this? How many people must they cheat and steal from before something can be done?

David Hasenick WD8BNS

BOYCOTT TRIGGER

Let me introduce you to one of the most efficient employees I have yet to encounter. This hard-working and dedicated person is — the TRIGGER TELEPHONE LADY!

As I had ordered an antenna from Trigger Electronics in July and was still awaiting its arrival in November, I called to ask why. That is when I first met the Trigger Telephone Lady! I could almost see her smile sweetly as she promised immediate action.

During that and four subsequent phone calls (so far), the Trigger Telephone Lady has compiled the following exemplary record:

She has succeeded in forgetting all previous calls, even when two were made the same day.

She has managed to place me on hold an average of twice per call (at long distance rates this is a rather convincing argument).

She has apparently lost every message she took as I have never been contacted by Trigger on the missing antenna.

Through all of this faithful service, she preferred no public recognition for her excellent work and consistently refused to give her name, job title, or employee number.

She has remained utterly faithful to her employer throughout, effectively insulating Trigger Electronics from all complaints so that they might continue to perform their dastardly deeds unhampered by the outraged squawks and protests of their victims. All Hail to the Trigger Telephone Lady!

Gary S. Breschini WB6NCK
Salinas CA

P.S. How about including "Boycott Trigger Electronics" on all QSL cards being sent to Novices, that they too may join in the praise of these turkeys?

FISHY

Just a short note to you regarding the letter in your column about IL *vs* Trigger. I have sent the Attorney General's office my incident with Trigger, that Trigger must have my check in their hands, cleared by the bank, before I could come in the store to pick up any merchandise, if they had it in stock. Sounds fishy, huh?

Thank you for your kind attention.

Art Surges
Evergreen Park IL

P.S. I took my business elsewhere.

IRKED

As a subscriber to your mag, I thought that I would write you about one of your 1975 articles.

This is in reference to the Levy Associates ad, this company formerly of Temple City CA, now of 1037 E. Lemon Ave., Monrovia CA 91016. For approximately $110, I purchased a ÷10 and ÷100 prescaler. This did not work with my MICRO Z FM 36 counter; however, I assumed that the counter's sensitivity was low. So then I purchased a Hewlett-Packard 5381A counter and a Davis (Tonawanda NY) scaler. This combination works perfectly.

I then sent my prescaler back to Stanley Levy WB6SCU on 4 Oct., 76, at their request. Early this year I received the scaler and he said they had a hard time getting the ÷100 IC; it is a Plessey. Believe this is an English make; he also said they have discontinued manufacturing this scaler due to trouble getting this part.

Well, at any rate, not sure if they ever did replace the IC. It doesn't work anyway, so have resigned myself to *never* ordering any gear from a small manufacturer, though I will say I am happy with the way the Davis divider operates.

Always liked to patronize small companies — but never again.

Have about $10,000 of gear here, so can afford the loss, but it sure irks me.

Larry Briggs W3MSN
Oxon Hill MD

Don't prejudge all *small companies — that's where the big ones come from. — Ed.*

HIGHLY RECOMMENDED

During this day and time when there seems to be so much emphasis on the negative, it is nice to get service from one of your advertisers, Communications Specialists in Brea, Calif., like I did. I ordered their ME-3 on Monday and I had it the next Monday. This is real VIP treatment. No waiting for my check to clear the banks and they sent my ME-3 UPS Blue Label Express, all prepaid. You can bet that I will highly recommend them to my friends. And the unit works A-1.

Dr. William W. Fulcher, Jr.
K4RTA/W4AST
Madison TN

ARRL ON TOP

In Dec., 1976, *QST*, page 38, recent equipment (HAL's FYO keyer paddle) is described. When I attempted to order one, I discovered that HAL is no longer making them — ARRL is really on top of things. I became angry and decided to see if I could make one myself. It proved much easier than I had imagined, and was made entirely from the junk box. It required only simple hand tools such as a hacksaw and a small round file. Mounted on a walnut base, it is also good-looking.

Every CW op to whom I have mentioned the project has been interested, and several have sent an SASE for a sketch. And so I ask if you might be interested in an article, "The Poor Man's FYO," with photos and sketches, etc.

Fred Maas WA5YTX
Santa Fe NM

Do it. — Ed.

THE GENTEEL HALF

I'm sure you'll find this one interesting from the "genteel" half of amateur radio.

Christine Boniakowski WA2KOU
Neptune NJ

Editor — *QST*
American Radio Relay League
225 Main Street
Newington CT 06111

Dear Sir:

I have been an amateur radio operator for approximately four years and absolutely love being a part of a

"man's world." I enjoy taking part in contests and am quite surprised by the different reactions I get from various operators when I am on the air.

However, it has come to my attention in the last few contests that there must be some guidelines established regarding the use of the national calling frequency of 146.52 MHz. The contests I am specifically referring to are the recent June, 1976, and January, 1977, VHF Sweepstakes.

In my opinion, it's not very fair for people to monopolize the national calling frequency for solely high power contest use since VHF Sweepstakes are intended to test both equipment and operating skill. However, it is quite obvious that there are many of us who are fortunate enough to have top-of-the-line equipment, including big arrays and kilowatts. These are fine at the low end of the band but not on 146.52.

In addition, since when have the FCC regulations been changed to allow a reverb on the air? I did not know that hams were in the radio broadcasting business.

I would like to suggest that 146.52 and all FM frequencies above 146 MHz remain contest-free and that the ARRL contest advisory committee look into the matter of suggesting alternate FM simplex frequencies for use during contests. Why should the FM bands be monopolized by a few who are inconsiderate and cannot leave the simplex bands alone for the purpose they were intended for — low power, mobile intra-community communications and public service.

I have been informed that the ARRL has refrained from publishing letters that tend to question its activities, of which the VHF Sweepstakes are a part, but it will be interesting to see how much attention a female rocking a male boat will receive.

Thank you for your consideration in this matter. I hope that there will be changes made in the near future to safeguard the FM bands from being hoarded by the "big guns."

Christine Boniakowski WA2KOU
Neptune NJ

She said it. — Ed.

RETROSTEP

San Antonio, which was among the earliest proponents of the Texas Band Plan for VHF/UHF FM (which was later adopted almost en toto by ARRL as a National Plan), joins the Bicentennial Celebration by virtue of a retrostep which sets orderly spectrum utilization back 20 years, if not the full 200.

South Texas first provided the English language with the word "maverick" during the mid-1800's when rancher Samuel A. Maverick allowed his unbranded cattle to roam the open range.

To top Sam Maverick's independence required considerable effort, but alas, it has been done. San Antonio now has a maverick to top all mavericks: WR5AFF/5 (no challengers please). This ill-conceived maverick repeater, licensed to Robert J. Sarvis WB5CIT, has its input on 146.39 MHz and output at 147.51 MHz (a designated simplex channel). With a rather unique spacing of 1120 kHz, this anachronistic machine conforms to accepted practice only in that it operates with low in/high out, and uses a 30 kHz channel for its output. Whether or not this was due to some oversight, or confusion caused by the choice of 146.39 MHz, which isn't even a half channel, could not be determined.

Please consider the creation of a Maverick of the Year Award to properly honor the contemptuous disregard for established order which characterizes such operations as this. The efforts of thousands of dedicated amateurs to voluntarily regulate themselves and promote orderly growth and spectrum usage appear wasted on our barbaric brethren.

Robert G. Wheaton W5PKK
San Antonio TX

GET OFF OUR BUTTS

After three unsuccessful tries of obtaining publication in QST (you remember, that's the organization "devoted entirely to amateur radio" — I understand that slogan will be mounted on the new $800,000 wing of ARRL Headquarters, Hi Hi), I thought after recently subscribing to *73 Magazine* and liking what I saw, I would appeal to you.

My message to our wonderful ham fraternity is this: Let's get off our butts and devote the same amount of energy towards publicizing and promoting amateur radio as we do denouncing the CBers and their band. Recently coming up from the ranks myself and passing my General theory, I do not believe the majority of amateurs are aware of what's going on in today's advanced CB market. In particular, I am talking about the so-called SSB HFers who operate between channel 23 and the ten meter Novice band. This group of bootleggers numbers over 70,000 with their own published callbooks and specialized illegal callsigns. Sure, a lot of these interested shortwave radio enthusiasts are running amateur equipment. It is easily available and the distributors and manufacturers of this equipment see the money in this market and of course are not going to establish any rules or regulations to prohibit sales. All we need to do is grab the "cream of the crop" from these ranks and talk about, demonstrate, and third party these fellows right into ham radio. The old tightwad image of the average ham radio operator is changing. These fellows already have been practicing Morse code, know about propagation, and have erected everything from tribanders to inverted vees. Still a nonbeliever?

Take a look at the gear confiscated in recent raids in the Baltimore area (*73*, January, 1977, page 12 — $65,000 worth), and that's just a drop in the bucket compared to other populated areas.

My point is this: For years we have been searching through our local clubs, etc., for people interested in getting into amateur radio, people who have no idea at the beginning what shortwave radio is all about and become easily turned off at the expense of getting into many areas of ham radio. We are looking in the wrong places. Get out of those department store and shopping center exhibitions and try going to some of the CB coffee and breakfast breaks on Sunday mornings. In my area, the hams meet at one end of the restaurant and the CBers in the other. Ridiculous, isn't it? Let's get together.

Mike Stone WB8QCD
Durant IA

MORE Z-80

I'd like to add my thoughts to yours concerning the Z-80 CPU chip in I/O Editorial in the December, '76 issue of *73 Magazine*.

Those of us who already own a 8080 based microcomputer can hardly be expected to junk a perfectly good CPU card and run right out and buy a Z-80 CPU! Remember that for many of us it was all we could do to get that 8080 based machine into the house — past all of the cold stares of our spouses, our friends, and our creditors.

Obviously, the Z-80 chip is intended for the "unlucky" souls that have yet to buy their first computer (that includes me). I am enthused about the Z-80 chip — precisely because it is advertised to execute 8080 programs without reprogramming! Furthermore, there are numerous new instructions that would appear to be valuable for a general purpose computer to have. Thus this Z-80 chip appears to give me the best of both worlds! Easier implementation electronically only sweetens the deal.

In my year of studying all of the uP oriented articles in *73* (and *Byte* and anything else I could get), I had largely ignored the 6800, 6501, F8, SC/MP, and all the rest, because I sensed that right or wrong, the largest number of active and unselfish programmers were probably on the 8080 bandwagon. Had the Z-80 chip not come along, I would have bought an 8080 chip based machine. Now that the Z-80 is here, that is what I'll buy, on the basis that it is "upward compatible" with the 8080 chip.

I expect to use those fancy new Z-80 instructions only when writing programs for new applications, for which satisfactory 8080 programs were not available.

Concisely, when I write programs for the *Kilobaud Software Library*, I expect that they will be in Z-80 code, but I expect that I will also submit an 8080 version (to fatten my royalty checks?) that will be virtually the same program except that each of the Z-80 only instructions would be replaced by a CALL to a subroutine that effectively emulates the replaced Z-80 instruction in 8080 code.

Kenyon F. Karl
Waterville ME

A REAL STATION

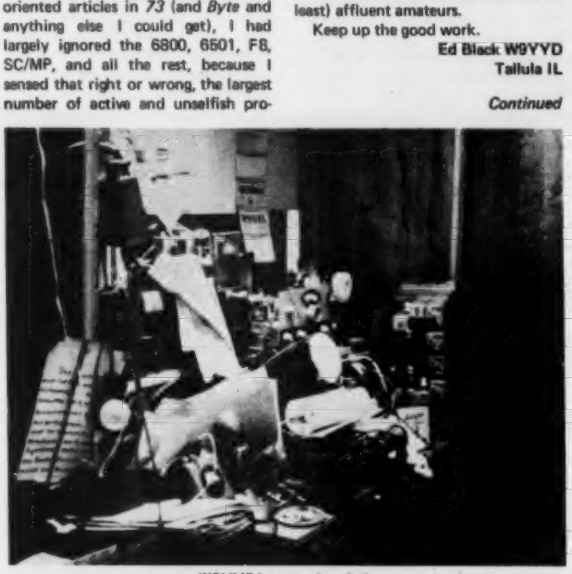
Along with my sub extension, I thought I would send along a minor gripe. It is about all those pictures of shacks and operating benches, desks, etc. I don't know how those people can even get on the air with those setups! Don't they know that clip leads, wires, and cables are essential to normal operation? Also, where else can you hang schematics, girlie pictures, calendars, logbook — to mention only a few. I am enclosing a photo of a *real* station. As you can readily see, everything is within easy reach — no hunting around for stuff. Band changes are a snap — merely move clip lead(s) from here to there. I didn't include a photo of the repair and building bench, as it is a mess.

But seriously, you have a fine magazine. It is the only one (of four originally) to which I still subscribe. The others seemed to aim their articles toward the more (than me at least) affluent amateurs.

Keep up the good work.

Ed Black W9YYD
Tallula IL

Continued



W9YYD's operating desk.

Steve Welsh WB9MLM serving as net control for March of Dimes Bike-a-thon from his hospital bed.

NEVER SAY DIE!

Here's a picture that the XYL took, and I think it's a good demonstration of the fact that hams are crazy enough to operate anywhere! Members of the Twin Ports Two Meter Club of Duluth, Minnesota, and Superior, Wisconsin, recently ran checkpoint communications for the March of Dimes Bike-a-thon. I had planned to help, but was hospitalized with an acute asthma attack. But between sessions on the respirator, I served as net control station, operating through WRØAIM, Duluth's 34/94 repeater. I was able to access it easily with my HR2A and a ¼ wave. Never say die!

Steve Welsh WB9MLM
Superior WI

LLOYD AND IRIS

We have just finished another successful DXpedition at VP2EEQ, Anguilla. Some 8,000 QSOs were made with amateurs in 123 countries. Operation was on 28 through 3.5 MHz, with very heavy concentration on 3.5 MHz.

Anguilla was different from our other Caribbean stops for two main reasons. There is no town or city in Anguilla, at least not in the normal sense. There are some stores, banks, etc., but they are widely separated and not in one downtown area. The other difference is that there is no central electric power system. Most people, including ourselves, have to obtain their electric power from individual electric generators. Our generator broke down just before we left and our stay in Anguilla was, therefore, cut short by a few days.

The people of Anguilla are very friendly and helpful. A radio amateur license is obtainable immediately, upon payment of $25 US. The country is relatively flat, which is a welcome change from most of the nearby countries which are mountainous, making it difficult to find a good radio site.

We ended 1976 with more than 70,000 QSOs operating from nine different DX countries.

KV4AA, a YASME Director and former President of the YASME Foundation (QSLs via YASME after 1 January 1977), finished the year with over 35,000 QSOs, all from AJ3AA.

It is most likely that every serious DXer in the world made at least one QSO with a YASME station in 1976. We hope that 1977 will be as good.

Lloyd Colvin W6KG
Iris Colvin W6QL
Anguilla

NEED VE6?

I got a hold of a couple issues of *73* and have already sent my subscription for 3 yrs. This VE6 thinks you have a great mag. Your editorials are great. I would like to see some beginner's basics on microprocessors.

Also, any W/K stations looking for VE6, I am on most afternoons on 14.300 or 21.300 and would be glad to contact.

Keep up the good work, Wayne. See you at Orlando Hamfest.

Arnie N. Brown VE6ARD
Calgary, Alberta Canada

ATTICA

At present I'm doing a stretch here in Attica Prison and the only way I can keep up with what's going on in the ham world is through reading. Seeing that I can't pop over to the local radio emporium for my monthly copy of *73* anymore, I finally have to subscribe. In a few days you'll be getting my money order for $9.00 a one year subscription. If the price has gone up, please let me know and I'll send the balance pronto. In the meantime please start with the Jan. 77 issue.

I'd subscribe for longer but I'm hoping to win my appeal. But if I should lose what's your rate for 15 years?

Two questions maybe you can help me with. Know anybody who would like to buy a used Drake TR-22C in good shape, except for the antenna which was broken while being chased by the cops? Plenty of crystals and cheap. Also my trusty ole Galaxy III, ac power supply, VOX, etc. Will sell all my gear cheap because I need money for my lawyer. And do you know any ham who would like to write a ex-ham in prison? A YL would be great! But I won't be fussy.

Looking forward to reading *73* again.

Peter Neenos
Box 149-75C275
Attica Correctional Facility
Attica NY 14011

NEED BY?

You can say "I told you so!" So far I have run into brick walls on operating privileges. Most people don't know what I'm talking about, or act like it. One guy around my age (43) said his buddy was one "before liberation" (1949) up in Tiensen, about 60 km north of here. In the larger cities, I have been told, they let middle school age (12-15) children build and operate short-range radio transmitters and receivers (short-range = 100 feet).

I have a S/W receiver and can get CW on it but the only ham band it covers is 80m. So far I have not heard any K or W stations. Out of 13 Americans here, one is K5KNL, Fred from Texas. He lives on the top (3rd) floor and has an "outdoor" antenna on the roof. He can get 20 and 15 occasionally. We are straight west and a little south of Pyong Yang, N. Korea, inland of the Pohai (Wide Sea) on North China's east coast.

I haven't given up, but the chain of command to do anything around here staggers the imagination. Tsang Chou, with a population of 170,000 (and they each have a bicycle!!) is classed a "rural town" and doesn't rate much attention. I wrote Peking about a license, but so far no answer.

Anyway ... much success in the coming year. If anything interesting develops I'll let you know.

Don McCoy WAØHKC
China

HARD KNOCKS

I am writing this letter in the hope that I may be able to save someone else a lot of pain and suffering.

I learned my lesson the hard way!

Whenever climbing a tower to do any work, BE SURE TO USE A PROPER SAFETY BELT, or *don't* go up!

On 7 June 75, I was standing on top of the top section of a 3 section crank-up tower which we thought was completely lowered. Because of some confusion, the safety belt I was planning to use didn't show up that day. I figured I would be able to stand on top and wrap my left arm around the six foot mast extending above the top while with my right hand install a two meter antenna on top of the mast. Just as I was about to install the antenna, the tower section I was standing on dropped two feet suddenly. I lost my grip and fell off, about twenty feet down to the ground. Luckily, I landed rather erect with my knees bent slightly, which helped to break the fall, and I went down hard right on my rear and rolled back onto my back in excruciating pain. An ambulance was called and arrived about three minutes later, although it seemed like an eternity due to the intense pain I was in.

After the ambulance ride to the hospital, which was very painful because every little bump in the road sent shots of pain through my body, I was treated in Emergency and X-rayed to find out the extent of injury.

I suffered a hairline fracture of the lumbar number one vertebra, or in other words, a broken back.

I have now been in bed for 22 days and shortly will be getting a plaster body cast which will run from just below my waist to my armpits, which I will have to wear for 8 to 10 weeks. Not very pleasant during the summer; however, as temperatures in Vancouver rarely exceed 80°C, it might not be too bad.

I figure I was quite lucky in that there was no lateral shift in the fracture and no spinal cord damage, so I will suffer no paralysis.

I am still fairly young (29) and was in good physical shape when the accident happened; otherwise, I might have been permanently crippled.

I expect to be released from hospital in about a week.

In a few months I will be able to climb towers again, but NEVER WITHOUT A PROPER SAFETY BELT, as anything can happen.

I hope you print this so that others can learn from my error and misfortune and avoid injury.

Matthew T. Lewis VE7CHI
Vancouver, B.C., Canada

DON'T PUT CBers DOWN!

This is in reference to the letter published in your Holiday 76 edition of *73* by Carol G. Sakowski about CBs and CBers. Granted, Citizens Band is not the finest radio service in the world, but I was quite disturbed by Ms.(?) Sakowski's statement, "Anything that 6 and 10 year old kids can do, you can do, right?" True. But then take a quick look at ham. Anyone, regardless of age, can obtain a ham ticket through a simple multiple choice and Morse code test. There are children on your frequencies too.

I feel it is time that people stop putting down CBers! Face it — where would ham be without CB? There goes a good deal of electronic components, and, by the way, where do all the Novices come from? *CB!* Another thing — Ms. Sakowski does not seem to have any call letters. All of that from a non-ham?

I have been into CB for exactly one year. I am an avid SWL, and am one wpm from my Novice. However, even after I become well into amateur radio, I am not going to forget my many friends on 11 meters. CB may be crowded, ridden with illegalities, and not very efficient, but there are plenty of would-be hams on 27 MHz who are trying to clean up the channels of flakes. We are not *all* the typical "10-4 Good Buddy" media CBers.

I am proud of my CB call letters!! Do not put CBers down if you want some new hams!

Jim Cullen WAE2NR
Succasunna NJ

SOMEDAY . . .

This letter comes not from a ham, but from a long-time would-be ham. I just wanted to let you know that if I ever make it, you'll get a large share of the credit (or blame). For something like 15 years I've wanted to get into amateur radio. For 14 years, I was convinced that I could never learn the code. Now I've got your tapes and everything seems possible. Not easy — just possible.

I've also got the license guide books you publish and find them straightforward and logical. That's more than I can say for some of the things put out by the ARRL. Right now I'm trying to learn some of the basics through the Heathkit Continuing Education series. While I'm speaking from a position of ignorance, you might want to consider telling your readers about this series. Heathkit seems to have put together a winner.

You are to be congratulated for your efforts to bring CB people into the ranks of ham radio. While there are some crazies on that band (I tune up there and listen from time to time), there are also some very interested and dedicated people. These are the ones who would be tremendous as amateurs. I figure the crazies wouldn't have the patience to learn what they have to know to pass the tests, so, even if you get their attention, they probably still pose no threat.

Congrats, again, for getting into the home computer field. It is my feeling that within the next 5 years or so there will be a home computer system with adequate software to appeal to the average homebuyer. The fact that the hobby electronics magazines have nearly all added computer sections recently shows just how far ahead of the pack *73* really is.

So, thank you, Wayne, for keeping me on the track. Between the rigors of starting a new business and the time required by continuing to go to college, I still find some time to study radio theory. Someday . . .

William F. Blinn
Worthington OH

TOYS OF THE PEOPLE?

I want to send this note for what it is worth.

I am a ham who was a CB nut at one time before they became the toys of people who seem to need something to convey their silly talk over.

I have always wanted to work with radio but never had the chance . . . CB radio got me interested. I believe there are a lot of CB men like me who are in earnest about radio and doing it right. I do not believe, however, we should try so hard to get them. If they are in earnest, they will seek it out.

Above all, we should not let down the rules to let them in. I have had one heck of a time passing the tests, and for all those who told me "there's nothing to it," I can only say "speak for yourselves." But I will also say that now that I have my ticket, it was worth every bit of it. And it means something to me to have done the work.

I, too, thought CW was nuts before I learned it, because I didn't want to spend the time learning it. Now I can see its value and fun.

The best drawing power the ham has is his dedicated interest and knowledge of radio and communications. Most of my old CB friends have no idea what I have learned getting my ticket, but I have found they all hold a special respect in the fact that I am a ham. And frankly, I tell them if they want to get serious about radio, this is the route to take. But until they are serious, they're not ready for us and we're not ready for them.

I cannot help but believe that the FCC and others in power in this matter hold a respect for what the ham world has become and contributed all these past years.

I for one am very proud to be a ham and thank all those who have gone before me in making it what it is today.

Thank you for your time . . . just must speak out.

Clinton J. Reser
New Strawn KS

SEARS AND 2M

It was with great distress that I observed a two meter transceiver on page 967 of the Spring/Summer 1977 Sears catalog. I hope you and *73 Magazine* will take an immediate stand and make a strong statement to both Sears and the FCC. I strongly feel that the open availability of CB equipment through mail order catalogs such as this with no requirement or proof of licensure has added to the number of unlicensed operators on CB today.

I sincerely hope that rapid action will be taken to eliminate the unlicensed non-ham from acquiring a two meter rig, complete with crystals, antenna, and instructions on ham procedures. We have been very lucky in the past to prevent violation of the ham bands and I hope we will be able to nip this in the bud before two meters becomes another eleven meters.

George H. Stokes, Jr. WA4MZL
Mobile AL

We're on the case! Check out the Montgomery Ward story in Briefs. — Ed.

THE LUNATIC FRINGE

The following is going to be difficult to believe unless you have been on the Bicentennial Net for the past several months. Many derogatory comments are made about CBers, but what difference is there when licensed amateurs cause deliberate interference in the following ways: jamming with carriers of up to 30 minutes and more, profanity, obscenities and indecent language (by definition), amateurs with high powered linears that move as close to the net as possible and refuse to move when tactfully asked to do so, whistling, blowing, tapping, and groaning into the microphone, playing a radio and transmitting a phone patch signal deliberately on net frequency. Tuning up on net frequency was always done without any regard or consideration for fellow amateurs — this appears to be entirely acceptable for many amateurs at any time. CBers discourteous???

All of the above did not dampen our spirits; however, there was one thing that was learned very quickly and that was not to acknowledge this type of interference. It is like the obscene phone call — leave them alone and they will go away.

The fellows acting as net control certainly deserve a lot of praise for their patience in keeping the net operational. One bright spot to all of this was the amateur who checked into the net from Kentucky and said he would accept a collect call from any part of the country to get on the air at any time for his state. That is *truly* the Spirit of '76.

Lloyd Krob WA0EFW
Eagan MN

The lunatic fringe lives. — Ed.

OPPOSING VIEWPOINTS

Thought you'd be interested in the enclosed clipping from *Computerworld*, regarding a radio program for ham-computer buffs.

In your January "Letters" column, you published a letter from AA7NEV, who didn't know what kind of time "PMEDT" stood for. Tell him it means afternoon or evening, Eastern Daylight Savings Time!

Your magazines, particularly the editorials, are always stimulating, generally thoughtful, and frequently controversial! Although your readers naturally don't agree with your points of view all the time, we gotta admit one thing: You offer, in the columns of your magazine, an opportunity for opposing viewpoints to be presented — a real rarity these days.

I only wish that all your reader-writers would use a little more courtesy in some of their comments, since the opportunity to present our views is a privilege *73* is granting to us, and not a right which we should demand and abuse.

Hang in there, Wayne!

Bill Houghtaling
Raleigh NC

You're kidding! If it's courtesy you want, read the letters in QST. *Don't bother looking here. — Ed.*

Hobbyists in Boston Getting Radio Show

CAMBRIDGE, Mass. — Computer hobbyists will take to the airwaves with their very own radio show beginning Jan. 22.

Believed to be the first radio series of its kind, "The Computer Program" will be broadcast on WBUR-FM, a noncommercial radio station with a 100-mile radius in the Boston area.

The format of the show will feature a guest who will speak on a topic of his choice and answer questions from listeners, according to Richard Gardner, host and originator of the show.

The program will also include news items of interest to the home computer hobbyist and a weekly announcement of resources related to the speaker's topic.

The program will be available to other stations and parts of each program can be broadcast as separate programs.

Further information can be obtained from Gardner at Box 134, Harvard Sq., Cambridge, Mass. 02138.

THE FEES DEBATE

I used to sit back comfortably secure in the thought that the people who run our country and agencies such as the FCC were so much brighter than myself, but now I really am worried. I just heard today that they (FCC) are going to eliminate all license fees from CBers and hams. I sure don't understand this. From one side of the FCC's mouth comes word that they don't have enough money to police the wild antics of the CBers, and from the other side they say we have so much money, let's forget the license fees.

The wild rush to the CB bands had already started one quarter of the way when the FCC decided to lower the rate to $4.00 from $9.00. It definitely wasn't lowering the rates that increased the CBers. Maybe the FCC didn't know how to handle the tremendous amount of money that would have come in if they left it alone. My calculator does not go that far, so I can't tell you how much money would have come in.

Does the FCC think that by dumping the $9.00 it will increase the ham ranks? When a prospective ham is ready to spend from $700 to thousands for ham equipment, what difference would $9.00 make? I would sure be interested in knowing how much money the FCC throws away by dropping the fee from $9.00 to $4.00. I wonder how many men could have been hired by the FCC in each state for police action by the money that was thrown away.

Harry Torossian WB8SWD
Dearborn Heights MI

FREEDOM OF INFORMATION

Thomas Houser, Director
Office of Telecommunications Policy
Washington, D.C.

Dear Mr. Houser:

Your recent letter to FCC Chairman Richard Wiley claims that "the federal agencies that compromise the OTP-chaired Interdepartment Radio Advisory Committee have studied all of the frequency bands currently under government control to determine whether any additional spectrum might be made available for Citizens

Continued on page 60

Briefs

Compiled by Warren Elly WA1GUD and Stan Miastkowski WA1UMV

How many times have you spent the day getting to the nearest FCC office, struggled through an exam, passed, and dragged yourself home . . . only to wait two or even three months for your new license? It's frustrating, and soon to be a thing of the past. Field Offices, starting sometime in March, will issue temporary authority for amateurs to use their new privileges before receiving the Gettysburg paperwork. The temporary permit will be good for 90 days and will require special identification while operating under temporary status. FCC's Greg Jones told *73* the March target date wasn't definite, but instead a goal.

The Long Island Mobile Amateur Radio Club (LIMARC) ATV repeater became operational on a regular basis at the end of January. The 439.25 in, 427.25 out machine is located in Plainview NY on a 320 foot antenna. It has an ERP of 200 Watts and is omnidirectional, allowing amateurs within a 20 mile radius to use its facilities.

Ed Pillar W2KPQ, Chairman of the LIMARC ATV Committee, and 30 members built the machine in their spare time from converted components. Most of the equipment and parts were donated by local industry and salvaged from various commercial sources. The club estimated the total cost in the vicinity of $2000, and will be running an experimental educational program on amateur radio and basic electronics in three schools within the Syosset NY school system.

The club is also planning to move its weekly technical net to the ATV repeater, with the visual medium giving an added punch to technical discussions.

The one year grant for the use of the 420 to 450 MHz band for experimental ATV repeater operation was issued on February 27, 1976. LIMARC has asked the ARRL board of directors to petition the FCC for a *five* year extension of the grant, citing the fact that last March the FCC granted offshore radio location (HIRAN) an extension for that period of time.

The FCC's proposal to deregulate (and decontrol) repeaters (see Guest Editorials and FCC) has drawn mixed reviews from the Ohio Area Repeater Council. Meeting January 8th, two days after the FCC proposal was released, the council voted 55 to 6 *against* elimination of repeater subbands, repeater licenses, and repeater callsigns . . . as Docket 21033 calls for. Instead, the council's officers were instructed to file comments with the Commission, "asking for continuation of repeater sub-bands, licenses, and callsigns, and for establishment of procedures by which the FCC will secure the comments of frequency coordinating groups such as the Ohio Council before acting on an application for a repeater license." The Ohio group did like the FCC's plan to simplify logging requirements and restrictions on remote bases and auxiliary links. Thanks W8GRG.

The Amateur and Citizens Division name change wasn't supposed to take effect until January 20th . . . but receptionists were answering the phone with the division's new name ("Personal Radio Division") the week before. There are no changes in the division's operation as of now, but the future could incorporate other radio services like private aircraft and marine.

Even if you try to pay the FCC for your new license or renewal, the Commission will still refuse. As reported last month, all fees were suspended by court order, effective January 1st. If you do send a check, the FCC will destroy it, and advise by mail. Cash or money orders will be refunded by government check. FCC officials, at press time, were still investigating retroactive refunds dating back to the court decision's effective date.

Topics expected to come up at the January 20th ARRL Directors meeting included a hike in League dues and a formal vote on the League's reply to the FCC docket on WARC. Some sources said they expected dues to go up $12 in the US, with the cover price of *QST* up to $2. (We'll have an update in Briefs next month.) On WARC, a letter to ARRL directors shortly after the FCC released its WARC proposal indicated the League would continue to push for new allocations at 10 MHz. See comments of Dave Sumner K1ZZ in last month's WARC report.

The case against Irael Treger W9IVJ continues in Chicago. Illinois Assistant Attorney General John McPhee says things are proceeding slowly, with the latest developments only promising further delay. McPhee is trying to get a court injunction barring Treger's company (Trigger Electronics) from advertising or carrying out business by mail. Over 350 people have complained that they mailed orders to Trigger, received their cancelled checks, but never got what they ordered. According to McPhee, about a third of the complaints have now been settled, "either to the total satisfaction, or partial satisfaction, of those concerned." However, with Treger hospitalized after suffering a stroke in early January, the chances of most victims recovering their money begin to fade. As McPhee put it, "The Judge may well tell us to leave Mr. Treger alone, concluding he has suffered enough already." In other words, after months of stonewalling the AG's demands for financial statements and depositions, Irael Treger continues to send out his catalogs and collect money from unsuspecting customers . . . and it seems like the courts may let him get away with it. Justice, anyone?

The role of amateur radio as a valuable public service was once again demonstrated after an earthquake in northern Italy last May. Details of amateur radio's part in the disaster have just become available. Repeater stations survived the shock and passed the word of the quake to the outside world. Next day 200 members of the Italian emergency corps established an emergency network to assist authorities in rescue efforts. The activity continued for nearly two weeks and was acknowledged with thanks by government authorities.

The on-again, off-again "Big Noise," the broadbanded buzzsaw interference that has been disrupting worldwide communications, was off at press time. A high-placed FCC source said that the Washington offices had received no complaints since the first of the year.

The noise had tapered off toward the end of 1976, and the FCC added that there seemed to have been a concerted effort to keep the noise out of the maritime and aeronautical safety services.

As reported in *73* last month, the Soviet Union admitted that the noise was coming from their country and was an "experimental use of the radio spectrum."

World mass media picked up the story toward the end of 1976 and speculated about the nature of the noise. Although many experts consider the noise a propagation study, some journalists have theorized that it was an experiment in the disruption of worldwide communications which could be used to create havoc with an army's communication during a war. Yet another farther out theory considers the possibility of the development of a "death-ray."

Whatever the nature of the noise, it seems to be gradually disappearing. FCC spokesmen did add that any further reports would be appreciated, including the time, frequency, and type of interference.

Just before press time, the "DX Jukebox" program of Radio Nederland in Hilversum reported that the Reuters News Service had quoted the Norwegian Defense Minister as saying US intelligence sources had indicated the radio interference was from a very powerful Soviet over-the-horizon radar, which could track aircraft anywhere in the world. Due to the extremely long range of the radar, it had to operate in the HF band rather than the UHF or VHF spectrum. It was further stated that the interference was coming from four transmitters, two located near the city of Kiev and two near the city of Nikolaev, both in the Ukraine.

The largest radio telescope in the world for ultra-short wavelength study has just been completed near the Amherst campus of the University of

Ed Piller W2KPQ, Chairman LIMARC ATV Committee, with ATV repeater.

Massachusetts in the western part of the state. Dr. Richard Huguenin, Director of Radioastronomy, in a *73* interview said the 45 foot dish has been under construction for nearly three years. It's fully steerable and enclosed in a geodesic dome.

Radiowaves in the one millimeter region (300 GHz) will be studied in an effort to understand interstellar molecules and their role in the birth of stars.

The installation was funded by the National Science Foundation and the Commonwealth of Massachusetts. It will be used by scientists from around the world.

Lowdown is a new monthly newsletter designed for the interest of LF band enthusiasts 540 kHz and down. A one year subscription is free to anyone who sends 12 SASEs to H. John Clements, 9010 Tobias #258, Panorama City CA 91402.

Persons involved on both sides of the RTTY/repeater controversy on 146.70 MHz in the Ohio area continued to take hard lines at press time. As reported in the January issue of *73*, Robert Scott W8FSK organized RTTY enthusiasts to protest a new 10/70 repeater on the frequency, which had been used for RTTY nets.

A great deal of correspondence between RTTY operators and the Ohio Area Repeater Council was generated, and the Council took up the issue at its January meeting. According to the minutes of the meeting, "It was agreed that if the individuals concerned had requested approval of 10/70 for a RTTY repeater before the voice repeater group asked for the pair, the RTTY request would have been approved. However, as there has been no such request, and in view of the use of other repeater pairs for teletype elsewhere in Ohio, the membership confirmed its earlier approval of 10/70 voice repeaters, and reaffirmed its decision not to reserve any repeater frequencies for direct use on either RTTY or voice."

Scott vowed to continue the fight against the use of 146.70 for voice. With the situation deadlocked, bad feelings abound and both sides seem to be drifting farther apart.

Opinions vary on the success of "Repeater Appreciation Week" in California the first week of January. Twelve major systems and virtually all of the minors shut down for a five day period from January 1st through 5th. The shutdown was caused by increasing abuse and bad language on many repeaters in the state. WR6ABE was shut down for two months last fall because of the severity of the situation on that machine.

During the "appreciation" period, control operators monitored the input frequencies for emergency traffic. No major problems were reported, although some of those alleged to have caused the trouble appeared briefly on some of the machines left on.

By shutting off machines, owners and control operators hoped to motivate users to self-police the offenders. Many systems came back under rigid control of operators and were immediately shut off again at the first sign of jamming or bad behavior.

Although first reports after the resumption of normal repeater activity showed a noticeable decrease in bad behavior, the next few months will tell the story about the future need for more appreciation periods.

Looking for Smokey? Owners of Drake series R-4 receivers can now tune in to CB channel 19 by doing the following: Set the band selector to 28.5 MHz and the "xtal" switch to 160 meters. Rotate the preselector to 15 meters and the dial to read 535. 10-4 and thanks again good buddy to the Santa Barbara CA Amateur Radio Club.

As reported in the February Briefs, the Bicentennial Relay project had become bogged down in red tape. Congratulatory messages from 45 governors and the Mayor of the District of Columbia to President Jimmy Carter were held up for nearly two months, while Bill Miller K4MM pressed for an appointment. In Chicago, where the idea got started with the local Quarter Century Wireless Association Chapter and Eric Shalkhauser W9CI (a participant in the first Presidential Relay held back in 1916), Lee Knirko W9MOL tried to interest the media with little success. A Chicago press conference drew only one reporter, and in Washington it was much the same story. The messages were delivered January 12th to Mr. Carter's appointments secretary, Fran Voorde. An appointment with the President prior to his inauguration proved impossible for two reasons: Mr. Carter's busy schedule and the Secret Service's reservations. The SS reportedly worried that if the hams got a chance to present the new President with the messages, "every group in the country would try to do the same thing." *That*, in the security conscious minds of the SS, would be a major no-no. (Incidentally, W9CI's fine history of ham radio begins with this issue of *73*.)

St. Nick put out a lot of HO HO HOs on 2 meter FM.

An unemployed engineer, complaining that waves emanating from a car's citizens band radio caused him pain, hurled a cinder block through the car's windshield yesterday, police said. Two Nassau County police detectives riding to work in the car immediately arrested the engineer.

Police charged James O. Nelson, 32, of 2 Norway Pine Drive, Medford, with third-degree criminal mischief, a felony, and second-degree reckless endangerment, a misdemeanor, and District Court Judge Warren Doolittle ordered him held in lieu of $1,500 bail. The detectives, George and John Staudt, were not hurt. The two are brothers.

Nelson, a former employee of the Grumman Corporation, allegedly stepped from the curb at Farmers and Stewart Avenues in Bethpage at about 8 am. Police said he threw a nine inch by 12 inch cinder block through the windshield of George Staudt's car and walked away. The detectives went after Nelson and arrested him. The car had been stopped at the intersection for a stop sign, according to police, who said the Staudts were on their way to work in the Eighth Precinct. *Reprinted from* Newsday, *Garden City, LI, NY.*

Members of the St. Jude Hospital Amateur Radio Club and the Southern California ATV Club staged an ATV "first" on December 22. They made it possible for patients at the Fullerton hospital to talk with Santa Claus while viewing him on 432 MHz color ATV.

The project was set up by Joe Moell WA6JFP and XYL April WA6OPS, Director of Occupational Therapy at St. Jude's. The TV signal source was the hospital's color TV camera, with 432 MHz equipment provided by Ernie Williams WB6BAP and John Verna WA6CAS of the SCATV Club.

Santa visited each room in the pediatrics and long term rehabilitation units of the hospital by means of a battery-operated color TV set and ATV converter, wheeled from room to room. Patients talked back to Santa on 2 meter FM simplex. A realistic "set" for St. Nick was made by hospital therapists, and background sound effects of reindeer and workshop elves came from an endless tape loop. In order that there be no doubt of Santa's authenticity, he was thoroughly briefed beforehand of each patient's name and background.

Newsfilm of Santa's ATV visit was shown to all of Southern California Christmas Eve on a Los Angeles television station. Thanks to WA6JFP for story and photos.

The antenna zoning case of Walter Weber WA9FXG has not yet been settled. In January, *73* reported that Weber has been ordered to remove his 72 foot tower and antennas. The fight against the Des Plaines IL city council has so far cost Weber nearly $2000 out of his own pocket. At press time, it appeared that the city council was dragging out the case through numerous legal loopholes in an effort to drain Weber financially.

In court late in December, the Des Plaines city attorney filed a motion to have Weber's suit against the city council dismissed. Because no reason was given, the motion was denied. The city then filed a point by point denial

Ed Webb W9IPO, President of the Chicago Area Chapter, Quarter Century Wireless Association, sponsors of the Amateur Radio Bicentennial Relay, Prof. Eric (Shaw) Shalkhauser W9CI, Honorary Chairman, receiving award in Chicago of message from President Gerald Ford, with Lee Knirko W9MOL, Relay Chairman. (Photo by John Bayalis W9CSA)

of Weber's suit.

Most antenna zoning cases have been quietly settled out of court in the past due to vague zoning laws. This case appears to be the first in Illinois and one of the first in the country to actually reach the courtroom. A negative decision could make it difficult for amateurs to erect antennas anywhere in the country.

A fund has been started in an attempt to help pay for the legal costs of the tower battle. Contributions can be sent to WA9FXG Tower Fund, c/o Hajek & Hajek, Law Centre, Mannheim & Roosevelt, Westchester IL 60153.

73 West Coast Associate Bill Pasternak reports that although the 1977 SAROC in Las Vegas seemed well attended, complaints abounded from both amateurs and exhibitors. Early arrivals found that the hotel reservations had been almost totally fouled up and some were forced to return home before the proceedings began. Many remarked that the speaker programs were "bad." Amateur manufacturers and distributors who exhibited were bothered by the lack of interest from the crowds. Most of the advance sales had gone to microprocessor enthusiasts, despite the fact that only two micro manufacturers were represented in the exhibit hall.

Many exhibitors who had been at SAROC in the past were absent this year. One said he would not be back, adding that SAROC is a "dud, and getting worse every year."

A number of new products were shown at the show. Among them was the long-awaited Dentron MLA-2500 linear, as well as a new Drake transceiver, the TR-4CW featuring a switchable CW filter. Amateurs got a first look at the previously announced Atlas 350-XL, with digital readout and 350 Watts out. More HF equipment made its debut with two new rigs from Ten-Tec, the Triton IV, yet another digital readout unit, and the Century 21, a 70 Watt allband rig.

With the large part that VHF is playing in amateur radio these days, the majority of new equipment was for that part of the spectrum. VHF Engineering introduced a new line of 2 meter amplifiers. The record for mobile 2 meter amps will now go to TPL, who introduced a *250* Watt unit. Kenwood was showing the TS-600, an all mode transceiver for 6 meters that should be available soon. KLM introduced the VFO-711 for their 2 meter rigs.

Accessories were well represented with new crank-up towers from Tristo and Wilson, as well as Wilson's super heavy duty rotator, capable of turning half a ton.

One unique product was the Astro 200 transceiver from CIR. It has digital tuning that is done automatically in 100 kHz steps. You push a button up or down for tuning in the corresponding directions.

Dale Hoppe K6UA of Fallbrook CA is the proud holder of the second WAZ certificate for 75 meter phone, and the first for the northern hemisphere. An avid DXer since being licensed in 1941, Hoppe started working toward the certificate in January of 1973 and received it late in 1976.

When asked about the toughest zones, Hoppe said that the last, zone 23, was the most difficult. A confirmed QSO there with UA9NH/JT-1 in Mongolia put him over the top. Adding to the difficulties, zones 15, 16, 17, and 18 required long path propagation.

The first WAZ for 75 meter phone belongs to Dr. Juan Fernando EA8CR in the Canary Islands.

Hoppe uses a Kenwood driving a Henry 2K. His antenna system is a directive curtain using four delta loops, two driven and two parasitic, giving a 10 dB gain.

He is active on all bands, including 2 meter FM and SSB, and holds a WAZ on 15, 20, and 40, as well as a WAC for 160 meters.

After nearly a year of operation, an amateur radio club formed to promote the use of SSB on 2 meters is expanding at a rapid rate. The "Side Winders On Two" headquartered in Fort Worth TX has over 300 members located all over the country. Nets have been formed on 145.10 MHz to demonstrate the potential of the 2 meter band and the SSB mode for rag chewing and DX.

Requirements for membership are working two members on 2 meter SSB. A list of members and further information on membership can be obtained from George Bretz, Treasurer, Side Winders On Two, 3520 Livingston, Fort Worth TX 76110.

It appears that the USSR is on the verge of launching an amateur radio satellite. Persistent rumors coming from Soviet amateurs put the launch date at sometime in the spring.

Nearly a year ago, several Soviet hams told AMSAT in Washington that the satellite was built and was undergoing final tests. It was not launched due to an unexplained delay.

Details were sketchy at press time. An issue of a Soviet amateur radio magazine showed a picture of a 2 to 10 meter transceiving installation and hinted at its use for a new satellite.

Both OSCAR 6 and OSCAR 7 continue to have battery problems. At press time, AMSAT president Perry Kline told *73* that telemetry data was still being gathered, but it appeared that one of the 18 cells in OSCAR 6 had failed. Instructions were given to command stations to change the voltage rating at which the satellite was shut down.

AMSAT was considering two theories in an attempt to rejuvenate the cell. One was to charge it vigorously for a period of time. The other was to continue to discharge the battery and then recharge it. Each of the 18 cells supplies 1.8 volts at full charge.

OSCAR 7 developed a problem with one of the solar panels, causing a voltage reduction aboard that spacecraft. Kline said that it was expected that OSCAR 7 Mode B orbits would be switched to Mode C until at least the end of February (Mode C is Mode B at half power).

Plans are continuing for a concerted fund-raising effort for AMSAT. As reported last month, funding for OSCAR 8 and the Phase III satellites is a problem. AMSAT officials are considering several avenues for seeking contributions and still seek new members and volunteers. AMSAT is located at Box 27 in Washington DC.

The famous sound of Morse code's dah-dit may be phasing out for the maritime industry. This is because two communications satellites are in synchronous orbit over the Atlantic and Pacific oceans. These maritime satellites, built by Hughes, are owned and operated by a consortium of carriers headed by COMSAT General Corporation. Called Marisat, the satellites are currently relaying high-quality voice, telex, facsimile, and data over both oceans for the international maritime industry. Marisat also serves the US Navy for fleet communications.

A third satellite, for Navy use and commercial backup, was placed in synchronous orbit over the Indian Ocean last October. Four-foot-diameter ship antennas allow ships to make instant contact with home port or to be reached instantly by ship telephone. Ships can also reach other ships via the system's ground station for telex messages.

Reprinted from IEEE Spectrum, *The Institute of Electrical and Electronics Engineers, Inc., New York NY.*

Collins Commercial Telecommunications Division of Rockwell International has received a $25.5 million contract from the Corporation for Public Broadcasting (CPB) to build an earth station system.

Collins will provide an earth station system comprised of 150 to 165 stations for the new nationwide satellite-based television system that will serve the Public Broadcasting Service (PBS). It will be the first large scale application of small earth terminals for television distribution by satellite in the United States.

Collins will provide a turnkey station which will include receive-only ground terminals, interconnect links, and services such as frequency coordination and site selection, prototype and qualification testing, site preparation, construction, installation, and long term maintenance support.

With the new satellite system, PBS will be able to broadcast multiple programs to public television stations simultaneously, enabling each station to decide which program to air and which one to tape for later showing. The new system will also enable PBS to provide additional channels to enlarge programming options for various groupings of its stations.

The new system is designed to provide flexibility and access to public television stations not previously financially possible, and expansion of the PBS interconnection using its new satellite system will be less complex and costly than at present. Under present conditions, linking up of a new public television station often takes two to three years. With the new system, PBS can have a new ground terminal installed as quickly as the equipment can be erected and frequency coordination requirements met. Also, the costs of interconnecting new stations in the satellite mode are substantially less than such costs in the present terrestrial mode.

Signal quality will be improved with the new satellite system, because a single signal will be picked up at approximately equal strength by each receive-only ground terminal. Distance has little significance, of course, and signal deterioration will not occur as it does in terrestrial systems.

The new public broadcasting satellite system will utilize three transponders of Western Union's WESTAR satellite to beam signals across the continental US, and to Alaska, Hawaii, Puerto Rico, and the US Virgin Islands.

The basic television receive-only earth station system will include 10 meter "nominal" antennas, low-noise amplifiers ranging in temperature from 50° Kelvin to 300° Kelvin, and the new Collins 55U3-1SC frequency agile video receiver.

The single shelf receiver can be tuned locally or remotely to any of 500 channels in the 3.7 GHz to 4.2 GHz band. It also features a maintenance logic unit that can diagnose faults to the replaceable module level and an ac/dc dual-voltage power input capability for redundancy of primary power, if desired.

The terminals will be designed for a video signal-to-noise of 53 dB assuming a video peak deviation of 13.5 MHz and a carrier-to-noise of 14 dB minimum.

The PBS satellite system is expected to be operational by the fall of 1978.

Collins has been involved in satellite communications since the early 1960's, when Collins engineers transmitted video, voice, and data signals from Iowa to Texas by bouncing them off the orbiting Echo balloon.

A growing trend on repeaters is the running of simulated emergency nets on an unscheduled basis. The nets give emergency coordinators an indication of the areas covered by the machines used and the availability of volunteers, as well as being a valuable training exercise. How about trying the idea on your repeater?

The Santa Barbara CA Amateur Radio Club reports that you can't beat CW when it comes to a tough communications path. Recently, a pleasure boat in the Santa Barbara Channel asked for assistance on the CB REACT network. Because of radio problems, the boat could not be understood. Dave McCollum WA6RGJ was on duty. He determined that the boat owner was familiar with CW, had

him switch the radio to SSB, and key the mike in CW. The message was then passed successfully.

It may be that 2 meter rigs will be as common as CB radios on the shelves of the nation's large retailers. The two largest mass merchandisers in the country, Sears Roebuck and Montgomery Ward, are both in the process of testing the water in the selling of ham gear.

The spring-summer edition of the 1977 Sears catalog has a 2 meter rig sitting beside the CB listings. The 22 channel rig is accompanied by a full explanation of ham radio and a caution that a license is needed for operation of the unit.

A spokesman at Yaesu Electronics in California admitted to *73* that the Sears unit is manufactured by Yaesu in Japan, but is not offered under the Yaesu name in the United States.

Meanwhile, the Montgomery Ward store in Plattsburgh NY is the site of a test marketing program for amateur radio gear. Michael Hanrihan, communications products manager for the store, told *73* that he was in the process of contacting major amateur product manufacturers in an effort to build a complete choice of product lines. At press time, Hanrihan admitted that he was getting little support from the companies that he had contacted. Of three major manufacturers contacted, one insisted that the entire line be purchased, one promised to call back but never did, and one gave Montgomery Ward an outright negative answer, saying that they did not want to jeopardize their existing dealer structure.

Another roadblock put in front of Montgomery Ward was a requirement that they take care of all warranty work. Although the amateur department may not be as full as first envisioned, the store was successful in obtaining the Midland line of 2 meter rigs.

Top officials at both Sears and Montgomery Ward were reluctant to comment on their future plans regarding the amateur market. A Montgomery Ward official said that the success or failure of amateur products at the Plattsburgh store would be studied over a one year period. If the pilot program is successful, the company may consider adding an amateur department to all of its retail stores, as well as the catalog.

The reluctance of major amateur products manufacturers to consider mass merchandisers draws an interesting parallel to a situation which existed in the photographic industry nearly ten years ago. At that time, manufacturers of advanced amateur cameras and accessories were reluctant to sell to mass merchandisers, fearing a complete loss of business in photo specialty stores. When one company broke down and decided to enter the market, others soon followed, and a number of discounters suddenly were equipped with fully stocked photo departments. Instead of taking business from specialty retailers, the increased availability of the products created a whole new market which all shared. A vastly larger distribution network for amateur products could possibly create enough demand to give amateur radio thousands of new devotees.

Trio-Kenwood digs in hard to officially break ground at the site of their new offices in Compton, California. The 23,000 square foot structure is being built to TKC's specifications by Nova Construction Company and is scheduled for completion in April, 1977.

The problem of CB radio theft has finally come to the attention of the federal government. Several congressmen, including Senator Thomas Eagleton of Missouri, have introduced legislation into Congress that would make CB radio theft a federal offense. Two bills were introduced last session, H.R. 13222 and 13223, that would make such theft punishable by a possible $5,000 fine and one year imprisonment. The bills specify that a transceiver missing for over 24 hours would be considered to have crossed state lines, thus allowing federal law to take effect. All mobile transceivers would be covered under the proposed laws, thus including amateur two meter gear which is also highly susceptible to rip-off. However, in a conversation with Senator Eagleton's office, *73* was informed that the two bills had "died" when the last session of Congress ended. It is hoped that they will be reintroduced when the change of administration is complete.

The London Ontario Amateur Radio Club reports that a number of Canadian amateurs are having problems passing through customs with amateur units when returning from trips into the United States. The depressed market for 23 channel rigs in the U.S. has made them attractive to a number of Canadians. Since border personnel may not be aware of the difference between amateur and CB rigs, Canadian amateurs are urged to carry a photocopy of their license and the bill of sale for the radio. When entering the U.S., they should have Canadian customs officials fill out form Y38, which will record the unit as having left Canada and should facilitate easy reentry.

Tired of waiting for QSL cards from slow DX stations? Have patience. Two years ago, scientists at Jet Propulsion Laboratories in Pasadena CA sent a message to a star system that they believe has a high probability of having habitable planets. If an answer is sent back as soon as the message is received, it should be arriving here on earth in 48,000 years. Is a new WAG (worked all galaxies) certificate far behind?

The US State Department has announced success in its negotiations with The Republic of the Philippines. A reciprocal operating treaty was the result, effective October 25th. *From* ARRL Bulletin.

We've been getting some letters from MARS members of late, complaining about changes in their calls. Marc Leavey WA3AJR wrote of his belief that the FCC had purposely shuffled MARS calls to grant special bicentennial calls to the general amateur population.

"A little more than two years ago, the three MARS programs operated just as they had for decades. Upon entering MARS, an amateur would assume a callsign based on his FCC issued identification. The scheme was, where "n" represents the FCC Call District, thus:

Prefix	Army	Navy	Air-Force
Wn	An	NØ	AFAn
Kn	AAn	NØ	AFBn
WAn	ADn	NØ	AFCn

. . . etc.

"This was all well and good until about two years ago, when we were informed of a change.

"It turned out that the F C had determined that the calls were using on the MARS frequencies were illegal. The prefix 'AD3', as in AD3AJR, for example, was not a USA call at all, but rather one assigned to the tiny nation of Lower Ugorgi, or some such. Thus, to comply with international treaty regarding amateur callsigns, a change was in order.

"This declaration was of note for several reasons. First, it has been established in many other cases that the MARS program does *not* fall under the juriadiction of the FCC, but of the Inter-Agency Board (IAB), a faceless group which looks over military and government radio use. Further, there is no reason for MARS callsigns to follow amateur regulations as operation is not under the Amateur Radio Service rules, nor is it on amateur frequencies. Certainly the 'Command' stations, WAR, AIR, NAV, and NPG, have calls which do not follow amateur convention.

"Nonetheless, without a whimper, we complied. Our reward was:

Prefix	Army	Navy
Wn	AAMn	NNNØ
Kn	ABMn	NNNØ
WAn	ACMn	NNNØ

"Air Force was unchanged, Army got jawbreaker calls, and Navy people started stuttering!

"Then came the Bicentennial and the famed bicentennial callsigns. Looking suspiciously like the 'illegal' Army MARS calls, which were never heard on amateur frequencies, use of these 'special' prefixes was encouraged on all ham bands, especially in international contacts. Remember:

W = AC
K = AD
WA = AA
WB = AB

"Do you think, maybe, the *real* reason for changing the MARS calls was to provide the block for Bicentennial use?

"Well, now it's 1977, a new year. The celebration is over, the calls are gone. Of course, the FCC is now issuing the old Navy calls to amateurs (NnXX), having finished with the Army/Bicentennial calls. Is there any hope for us to get our old calls back?"

Marc I. Leavey, M.D.
WA3AJR-ACM3AJR
(ex-AD3AJR)
Randallstown MD

We're checking. Meanwhile, what about the scuffle for 1 x 2 callsigns? It's gotten to the point where you don't know whether you're talking to a seasoned veteran or an 18 year old kid. (More on the FCC's callsign shuffle next month.)

There *is* a place where Technican class licensees can operate SSB on HF, and where Novices can operate voice on 2 meter FM. It's the Military Affiliate Radio System (MARS) which is always looking for dedicated traffic handlers. Besides the extra privileges, MARS licensees are issued distinctive callsigns and are given access to surplus equipment. MARS units in many areas of the country are currently running membership drives. For further information, write: Commander U.S.A.A.C., Attn CC OPS OM, Fort Huachuca AZ 85613.

LIMARC, The Long Island Mobile

Continued on page 196

EDITORIAL BY WAYNE GREEN

from page 7

from the FCC. We are still far too restricted by the FCC to be able to set up much in the way of gentlemen's agreements on the use of our bands. If the FCC were to throw out the bandwidth proposals now under consideration (Docket 20777) and remove all restrictions on modes of communications, we would then have a situation where we could start governing ourselves.

Since the repeater councils presently represent about half of the active amateurs, we have a good start. Most repeater clubs have expanded to be regular ham clubs, with many non-FM members. Those which haven't opened up to non-FMers should get their act together ... how can you run Novice classes when Novices can't use FM? And what red-blooded ham club doesn't have a Novice class going these days?

Think about a structure for amateur radio founded on the radio clubs. Representatives of the clubs would meet with area councils to pass along the wishes of the clubs ... and bring back the ideas from other clubs. Council representatives would meet to agree on changes in our agreements on subbands, modes, etc. This would permit amateurs to keep up with technical developments, and should encourage the pioneering of new ideas. This would take only a national meeting of councils to be put into effect ... everything else is already in motion and working reasonably well.

Such a system would need a mode of communications ... a forum where ideas for changes in agreements could be discussed ... the pros and cons developed. It goes without saying that *73 Magazine* is available for this ... it always has been. Clubs can't be sure of getting all the information they need to make intelligent decisions unless there is a relatively free press ... and this comes down to *73*. *QST* is not known for allowing more than the ARRL side of things. *HR* seems to panic at any suggestion of offending *QST*, upon whom they are overdependent. I'll print just about anything in *73*, and whether I agree with it or not is irrelevant.

So there's an idea. You can let me know what you think.

MA BELL WISES UP

When Bell decided to use on-line signaling for long distance calls, a number of engineers advised against it. They pointed out that this would encourage the development of ways to defeat the billing for the calls. The engineers tried hard to convince higher-ups that they should use separate wires for signaling and thus avoid any problems with customers using signals of their own. The deaf ear turned to these engineers was not one of the brighter decisions made by phone company officials.

It was this decision to use the same wires for operating the dialing equipment as for the phone conversations which brought about the development of the red box, the black box, and eventually the blue box ... devices for getting around some of the on-line signaling. The engineers raised a chorus of "I told you so" as blue box use escalated. I suspect that the phone company reacted by firing the wise guys.

At any rate, Bell has recently announced that they are at long last setting up separate lines for handling dialing. With some of the newer high speed systems, one set of signaling lines will be able to handle hundreds of customer lines, since few signals will take more than a second or two to transmit. Bell is trying out the new system in Wisconsin and expects it to be all over the country in a few years. This will greatly speed up connections on long distance calls and will make it possible to make collect calls without the help of an operator. It will also thwart any blue box fans who are still not in jail.

MAIL ORDER RIGHTS

Since a good number of the ads in *73* are mail order ads, it may be helpful to both prospective customers and mail order firms if I go over the new mail order laws.

The Federal Trade Commission has some rules which go a long way toward protecting the mail order buyer. It really doesn't pay to fool around with these chaps, so read on and see what they've done.

A customer has the right to know when to expect merchandise to be shipped. If no date is set by the seller, you have the right to have your merchandise shipped within 30 days. If the seller does not ship within 30 days, you have the right to cancel your order and get all of your money back. The seller must notify you of the delay and give you a free means (postage paid reply). If the delay is 30 days or less, you have the right to cancel your order and get your money back, the right to agree to a new shipping date, or the right not to answer ... in which case the seller assumes that you agree to the shipping delay. If the shipping delay is more than 30 days, you must give your express consent to the delay, otherwise the seller must return your money at the end of the first 30 days of the delay.

If you cancel, you have the right to get all of your money back, and it must be mailed to you within seven working days after you cancel. On credit sales, the seller has one billing cycle to adjust your account.

If you have a problem, write to the dealer directly. If you don't get results, outline the facts, with a copy of the ad and a short letter, and send it to: Director, Bureau of Consumer Protection, Federal Trade Commission, Washington DC 20580 ... and please send a copy to Wayne Green, *73 Magazine*, Peterborough NH 03458, so I'll know when a firm is lousing up.

A CALL FOR PAPERS

It wasn't very long ago, historically, that one of our ham magazines was calling for those unused frequencies between 146-148 MHz to be made into a new citizens band. It probably wasn't so much cooler heads prevailing as the glacier-like movement of the FCC which saved our present repeater band.

Today we hear that familiar cry of "use it or lose it" ringing out plaintively, echoing up and down our many virtually unused ham bands. One or two furtive teenagers calling CQ every night do not constitute much of a foothold on an empty ham band. And since there is probably no way in this world to get that old-timer's tuning knob unfrozen from 3999 kHz, where he's been for over twenty years, we have a desperate need for newcomers.

Many clubs are doing a great job of attracting new blood to hamming. The big source of beginners in amateur radio has been CB, now that amateurs have discovered there are some nice people on CB, much to their surprise. Where in 1973 only about 50 ham clubs had license study classes, now almost 3000 clubs are offering these, and the result is a ham increase during 1976 of 22,497 (according to the Callbook) ... that's about an 8% increase ... showing that while we haven't grabbed the brass ring, we definitely are back on the merry-go-round ... to coin a phrase.

Prior to ARRL's "incentive licensing" fiasco, the ham growth had been about 11% per year for quite a few years. We certainly should get back on that schedule, at the least. I think we can do it ... heck, I *know* we can do it. We had to live with zero growth for over ten hard years, so we're pretty rugged.

I see the key to growth lying in the expanding interest in CB. With millions of people becoming familiar with two-way radio, I think we can spark a hamming interest in this tinder.

To spark this interest, we need to tell the world about the fun of hamming. Oddly enough, hardly anything has been written by amateurs telling about the various hobbies that go to make up what we call amateur radio. I'd like to see papers submitted to *73 Magazine* on every facet of hamming. These could be published in *73* ... put into booklets to go to CB clubs ... booklets in radio stores ... etc.

A paper should explain about one particular phase of amateur radio in terms a beginner can understand ... it should be well illustrated with photographs and any drawings or maps which will help explain. The deadline for papers for this competition is May 15, 1977. Winning papers will be published and the authors will receive a certificate of merit for their contribution to the growth of amateur radio ... plus a check for $250.

Papers which get honorable mention may also be published and will be paid for at regular rates ... the fact is that any well done paper will probably be used in this drive to convince CBers (and everyone else) that they should get their ham tickets.

Major facets of hamming:

DXing
Contests
Certificate Hunting
SSTV
RTTY
ATV
FM/Repeaters
Public Service
MARS
Nets
Traffic Handling
Oscar/Amsat
Club Work
Home Building
Antenna Experimentation
Novice Classes
Microcomputers
QRP
Mobile
Moonbounce
160m DXing
DXpeditions
High Speed CW
VHF SSB

Here is a way to have a lot of fun ... to give a big boost to your own special interest ... to help amateur radio in general ... and to get some recognition. There's nothing like being published in the magazine to make you an "expert."

Since the main purpose of these papers is to attract newcomers to amateur radio, be sure to start out with something dramatic if you can. Emphasize the fun ... be honest about the cost, but try not to scare off the beginner. Try to have the best pictures you can ... black and white. You might plan for one color picture later if the paper is a winner ... something that might be used on the magazine cover. This takes a very good camera and experience.

You might think of this as a way to help pay back amateur radio for the enjoyment it has given you.

WRITING FOR 73

What does an author expect from a publisher ... in addition to being paid well and promptly? Well, there is a bit of vanity in all of us and we want to know that our ideas will get the best possible distribution. We want to reach those who will be receptive to our ideas.

Since *73* has done most of the pioneering in the ham field, most of the top name authors have tended to write for *73* ... it is the best way for them to reach the people who count. There is no discounting the impact of *73* ... for instance, it was *73* which brought FM and repeaters to general use ... and it was the *73* push to get clubs to start hamming classes and get

Continued on page 34

A NEW STAR IS BORN! THE RPT 50 SIX METER NBFM REPEATER

WHY A SIX METER REPEATER?

1. Consistent coverage of over 100 miles is not unusual with use of modern equipment.
2. The variety of propagation affords an opportunity of working lots of DX-Stations from 400-2,000 miles away on multi-hop sporadic E, Auroral propagation of up to 1,000 miles, F_2 Skip during the upcoming peak sunspot cycle of over 2,000 miles. Plus transequatorial propagation is good up to several thousand miles.

THE NEW RPT 50 IS A COMPLETELY SELF-CONTAINED ALL SOLID STATE REPEATER. It is conservatively rated, and built of high quality components. Much care and attention to make this repeater versatile as well as reliable.

To best take advantage of the DX as well as the extended range capabilities we recommend our optional tone squelch board TS1 and TTD1 touch tone decoder.

The Model RPT 50 is supplied as complete repeater system. The receiver, transmitter, control circuitry, C. W. Identifier & 115/230 Volt AC power supply are all contained on a standard relay-rack panel and chassis unit. For most installations a user supplies AC power and suitable antennas with 50 OHM coaxial feed (PL 259 fittings). External connections for autopatch, tone control, etc. are provided. Built-in identifier programmed with up to 159 bits. Automatic emergency battery power changeover capability.

RPT 50 Kit $465.95
RPT 50 Wired & tested $695.95
(Export price is slightly higher.)

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C & A Electronic Enterprises, Carson, CA
Electronic Enterprises, Rio Linda, CA
SON Electric, Fresno, CA
Tele-Com Electronics, San Jose, CA
Westcom, San Marcos, CA
ZacKit Corporation, Vallejo, CA

COLORADO
Listening Post & Electromagnetics, Durango, CO
Communication Specialties, Aurora, CO

FLORIDA
Amateur Wholesale Elec's., Miami, FL
West Indies Sales Co., Ltd., Miami FL

ILLINOIS
Klaus Radio, Inc., Peoria, IL
Spectronics, Inc., Oak Park, IL

INDIANA
Communication Systems, Bourbon, In

KENTUCKY
Cohoon Amateur Supply, Trenton, KT

LOUISIANA
Frank L. Beier Radio, Inc., New Orleans, LA

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MICHIGAN
Harry G. Crofts, Northville, MI
Adams Distributing Co., Detroit, MI
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MISSOURI
Alpha Electronic Labs, Columbia, MO

NEVADA
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CFP Enterprises, Horseheads, NY
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Loffler Electronics, Ogdensburg, NY
VHF Communications, Jamestown, NY

NORTH CAROLINA
Vickers Electronics, Durham, NC

OKLAHOMA
Derrick Electronics, Inc., Broken Arrow, OK
Radio Store, Inc., Oklahoma City, OK

SOUTH DAKOTA
Burghardt Amateur Center, Watertown, SD

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Teco Electronics, Garland, TX

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A-B-C Communications, Seattle, WA

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BANKAMERICARD

New Products

HY-GAIN 3750 SSB/CW TRANSCEIVER

Every so often a truly unique radio appears on the scene, and after a few years it disappears almost as quickly as it arrived. The cutting edge is usually price. Signal Ones and HRO-500 receivers could only be afforded by a minority of amateurs, despite claims that hams are a wealthy, exclusive lot who can afford $2000 pieces of equipment. Figures I've seen recently project that hams will spend an average of $400 in the next 12 months on additional gear, and that doesn't seem to allow for many 2 kilobuck transceivers. The market then for radios like the Hy-Gain 3750 may be small, but it undoubtedly exists.

Hy-Gain has had its problems (*73* Briefs, February, 1977), but reorganization has divided the company's CB and ham divisions, and autonomy is bound to bolster the amateur side. A new 2m HT is now available (watch for a *73* New Product Review), and Hy-Gain's long-established line of antennas continues to sell well. The 3750 transceiver is the centerpiece in Hy-Gain's amateur plans for the future, and it represents state-of-the-art design.

Marketed by Hy-Gain here in the US, the 3750 is manufactured in Japan by National (no connection to the American company). Not many 3750s had reached the US at deadline, but by the time this issue gets to you, availability will be up. Most people we worked with the 3750 had never heard one before, and the radio caused quite a commotion as soon as stations realized what they were listening to. Several pileups were caused by the curious, but we couldn't find anybody who criticized the signal or the audio characteristics. The Hy-Gain has a distinctive sound, and many fellows were stumped trying to figure out what it was. Inevitably their reaction was, "Wow, that's that $2000 transceiver?" Yes, it is.

Okay, you're saying to yourself, "Why so expensive? What makes the Hy-Gain worth $2000?" Well, how about a phase locked loop circuit that locks the first local oscillator and VFO, resulting in direct injection into the 9 MHz first i-f, a total lack of spurs and images, dual-gate MOSFETs throughout the rf amplifier and mixer stages, a 20 dB pad . . . all in front of a narrow band SSB crystal filter? The CW filter is very sharp, but signals remain strong. A 50 kHz T-notch filter and 9 MHz crystal filter are designed to put the 3750 in a class of its own in notching unwanted signals. Then there's a gated noise blanker that functions like a squelch circuit in cutting pulse noise without reducing the receiver's ability to handle cross modulation. You really have to hear the 3750's receiver to believe it! After a few hours of using the Hy-Gain, it began to really show its stuff, sort of like learning to play an instrument. It's the best I've ever heard.

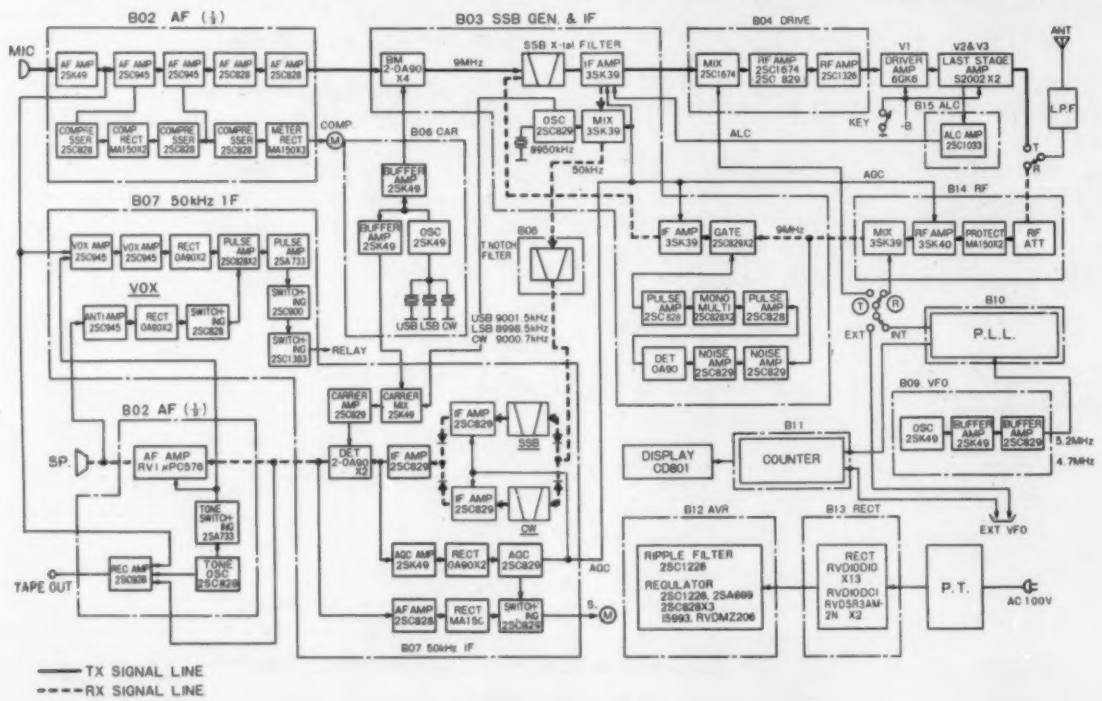
Our proving ground was 40m SSB, where broadcast interference and weak signals combine to produce enough noise to drive away all but the most dedicated DXers. It is uncanny how the 3750 sweeps the noise aside, through the use of notch filter, 20 dB pad, and noise blanker. As one *73* editor put it, "Using that rig on 40m was like talking on the telephone." He's right. Especially good is Hy-Gain's audio quality on receive, even on the built-in speaker. The speaker is mounted on the bottom chassis, but it never protested the wide variations in audio produced by tweaking the notch and noise blanker.

Dialing up a frequency is a simple matter of selecting a band, mode, and tuning the VFO until the digital readout displays the desired spot. If you go out of band, a series of LEDs flash on across the readout. The VFO's tracking is quick, so quick that you have to tune slowly . . . otherwise the counter will zip right by. RIT is included, of course, and when used in conjunction with the notch and blanker, it makes for easy copy in round tables and nets. The RIT actually registers on the LED readout, a feature unique to the 3750. Hy-Gain uses a bit different slant on memory readout than other transceivers employing digital readout. In the 3750, the memory LEDs are separate and allow off-channel tuning without the loss of the main tuning LEDs . . . other systems have only one set of LEDs that are switched between direct readout and memory readout.

The Hy-Gain 3750 is no mini transceiver. It weighs in at 44 pounds, and measures 16" wide by 7" high by 13" deep. Construction is solid, with a well laid out front panel. Band switching, final tuning, and RIT controls are to the right of the VFO. Receive controls are on the left with dual concentric pots for af-rf gain and mike level-audio compression. A row of toggle switches takes care of power (receiver only), heater (final and driver tubes), remote VFO selection, AGC range, compressor, and rf attenuation. A row of push-buttons covers modes and the tune position. Front panel jacks are provided for mike, headphones, key, and recorder output, with two rows of miniature pots for easy VOX adjustment, CW sidetone level, frequency counter calibration, and output meter sensitivity. The front panel is rounded out by a large well-calibrated multimeter which covers everything from plate current to compression level.

Band coverage goes a bit beyond complete. The Hy-Gain is set up for 160 through 10 meters, but more than enough extra coverage is included for MARS activity without the need for a remote VFO. A remote unit is available (model 3855) which allows selection of 7 crystal controlled channels. Interfacing between the transceiver and remote VFO is good, with the operator able to switch transceive functions between both VFOs, or separate receive and transmit.

Hy-Gain uses S-2002s (a pair) for finals, and a 6GK6 in the driver. Otherwise it's solid state all the way, with (counting the receiver as well) 98 transistors, 43 ICs, and 120 diodes. Construction is modular, with 21 boards (or modules) interconnected through computer type connectors,



Block diagram of Hy-Gain's 3750.

The Drake MN-2000
Antenna Matching Network

A study in operator convenience

(or—how <u>not</u> to hang upside down behind your operating desk in order to disconnect your tuner from the line.)

FRONT PANEL SELECTION of key operating functions. No need to manually connect and disconnect the unit from the line for bypass applications.

FRONT PANEL SELECTION of up to three different antennas, or two antennas and a dummy load. The two may be selected in the matched or bypassed mode in each circuit with the flip of a switch.

FRONT PANEL SELECTION of forward or reflected rf power with a built-in precision wattmeter — not just a relative indicator.

This coax to coax 2kW tuner will tame VSWR up to 5:1 at any phase angle. If your 75 meter antenna is flat on ssb, but has high VSWR on cw, this could be just the answer.

Excellent for beams that exhibit a high VSWR on the opposite end of the band from where you set the elements.

The MN-2000 provides an additional 25 to 35 dB second harmonic attenuation which can help reduce TVI.

Covers 80-10 meter ham bands. Considering the built-in coax antenna switch, by-pass switch and rf wattmeter/VSWR bridge, the MN-2000 is a real value at $220.00.

To receive a FREE Drake Full Line Catalog, please send name and date of this publication to:

The Drake MN-4
does basically the same thing as the MN-2000 but is rated at 300 watts.

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The Hy-Gain 3750 transceiver.

making for easy access to the boards. Hy-Gain provides an in-depth instruction manual of over 50 pages, covering everything from operating the radio to circuit theory. The manual is illustrated with many close-up photographs of the modules and scores of block diagrams and schematics.

The transmitter's main selling point is the audio system. ALC and audio compression are combined to keep average output up, and it works ... using a monitorscope we were unable to make the 3750 flat top or distort. On-air reports showed a preference for the *compressor*, a point that underscores the effectiveness of the Hy-Gain's audio system. Use of a pan-adapter by stations 50 and 1500 miles away showed no evidence of splatter, even with mike gain and compression levels turned all the way up. Output was measured at 190 Watts on all bands except 10m, where the Bird meter indicated about 110 Watts out.

The basic Hy-Gain 3750 (completely self-contained with power supply and speaker) retails at $1895. By the time you add a remote VFO and remote speaker, you're well over $2000 ($2460 to be exact). The Hy-Gain, make no mistake, is an impressive radio. A solid month of operation by three *73* editors produced no problems, and lots of great QSOs. The 3750 is built like a battleship, and refused to bother even the most ancient and TVI-prone TV we could find. After removing the top and bottom covers (a job that takes patience and time due to the tremendous number of screws), still more shielding had to be removed. The design reminded us of broadcast equipment. And we were left with the strong belief that the 3750, like most high quality broadcast gear, would last forever. *Hy-Gain Electronics Corporation, 8601 Northeast Highway Six, Lincoln NE 68505.* Test unit supplied by *C & S Marketing Associates, Algood TN 38501.*

Warren Elly WA1GUD
Associate Editor

OPERATING IMPRESSIONS OF THE HY-GAIN 3750

I was especially impressed with the receiver. In a crowded 40 meter band one Saturday night, I was able to take a signal, which was down in the mud, and enhance it until it was of the quality only produced by locals.

Signal reports from throughout the country while using only a dipole antenna confirmed the fantastic output from the rig. Many comments were made concerning the fine audio, and I was told by many that I had one of the strongest signals on the band.

The built-in speech compressor seems to be of excellent design. After many on-the-air tests with distant stations, it appears that the compressor does its job to get the signal through without any noticeable decline in audio quality.

Tuning the rig is one of the easiest procedures I have seen; it is virtually foolproof.

Rich Force WB1ASL
Associate Editor

For every hobby there is an "ultimate" unit. For the sports car enthusiast it's the Ferrari. For the amateur photographer, it's the Hasselblad. For the amateur radio operator, it's the Hy-Gain 3750 transceiver.

The 3750, besides being the most expensive amateur transceiver on the market, is also the best. It's state of the art, utilizing phase locked loop circuitry with dual gate MOSFETs in the rf amplifier and mixer stages.

The real beauty of the rig is the digital readout. In the 3750, you have not one but two. By flipping the little switch called "Memory," there displayed in front of you is the last frequency that you were on. No need to write it down. If you want to return to it, there it is. The second set of readouts also function with the external VFO, telling you where it's set. Talk about the arrival of digital electronics and convenience to ham radio – this is it.

Stan Miastkowski WA1UMV
Associate Editor

73 TESTS THE TUNERS

At the risk of provoking more controversy over swr and antenna tuners, 73 proposes to test every antenna tuner we can get our hands on. We're not going to do them all at once, because more often than not those kind of articles end up a meaningless buyer's guide to manufacturers' specifications. Instead, we're running them one or two a month after operating the units over a period of time long enough to judge actual performance. Frankly, we're beating the heck out of them, trying to decide, among other things, whether those specifications we mentioned earlier are in fact realistic.

And about all that controversy on antenna tuners – matching networks will not turn your 200 Watt transceiver and 35' high dipole combination into one of the "big guns."[1] *That takes a good antenna. But if you lack the 10 acres you'd like for an antenna farm, and can't handle a behemoth antenna for each band, read on ... one or two good antennas and a tuner could solve your problem.*

Take trap beams, verticals, and dipoles. Most are closest to "match" over a narrow portion of each band (often you have to choose phone or CW). Or fan dipoles, where the same elements are used on two or more bands, like 40 and 15 meters. In both cases there is a need for a tuner. Limited space is another reason. I'm living in an apartment, in a low signal TV area, with a 100' by 50' lot. The location's only claim to fame is three good size trees at the front and rear, with only enough room for two or, at most, three antennas (a tower could develop this spring, but only one tower, so I'll probably be forced to go the multi-band route there, too). Because of all this, an antenna tuner has become essential.

One more argument – the real impact of tuners is greater efficiency. Nearly everyone, on both sides of the swr controversy, can agree that transmitters run more efficiently when properly matched to a load. So far so good? It follows then that an antenna tuner can increase power output and prolong the life of your finals.

The debate continues over tube versus solid state transmitters, and even amplifiers are being caught up in it, as broadband output circuits catch on. Output really suffers when faced with mismatches that tube equipment finds relatively tolerable, so it may not be long before antenna tuners are as standard in ham shacks as swr bridges.[2]

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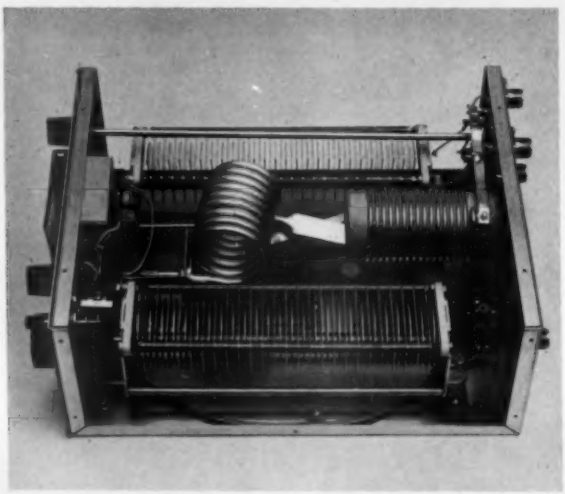
1 Rayer, F. G., "Exploding the SWR Myth," *73*, Dec., 1976, p. 122; Woods, Hubert, "Exploding the Power Myth," *73*, Dec., 1976, p. 120.

2 *73 Magazine* Staff, "The Super Transmatch," *73*, July, 1976, p. 150.

The Drake MN-2000 2 kW matching network. Note antenna switching left, power meter swr controls right.



The MN-2000 with two layers of shielding removed. Silver-plated coils and swr-power meter PC board are clearly visible.

THE DRAKE MN-2000

Now that we've convinced you you need an antenna tuner, consider the Drake MN-2000. This is a high power matching network, capable of handling well in excess of the legal limit. The silver-plated switch contacts and tank coil are the first clue, along with the spacing of the MN-2000's nearly foot long tuning capacitors.

Drake's tuners (both the 2000 and 200 Watt models) are double shielded, with the typical Drake copper-colored chassis and black cabinet. SO-239 coax connectors are used throughout, with a ground post the only other rear panel connection.

The MN-2000 has been around for years, and the original design has held up well. Coverage is 80 through 10 meters with an insertion loss of less than half a dB. The Drake took everything an SB-200, Henry 2K, and Alpha 374 could offer . . . willingly. Even faced with extremely bad mismatches, the MN-2000 tuned easily and without the confusing series of dips usually associated with transmatches.

The Drake is really several station accessories in one – aside from being an antenna tuner, the MN-2000 serves as a wattmeter (comparing most favorably accuracy-wise with a Bird unit), swr bridge, and antenna switch. A large well-calibrated multimeter dominates the front panel, with wattmeter and swr controls right, and antenna switching for three antennas left.

A unique feature on the Drake is its ability to completely take the tuner out of the line, while maintaining wattmeter and swr functions. Two antennas can be switched in this way, with the third antenna switching position wired straight through (excellent for a dummy load).

The MN-2000 is a component of the Drake system and, like the rest of the Drake line, its layout is classic. (Those of you who didn't go through junior high dreaming about girls and Drake lines really don't know what you missed!)

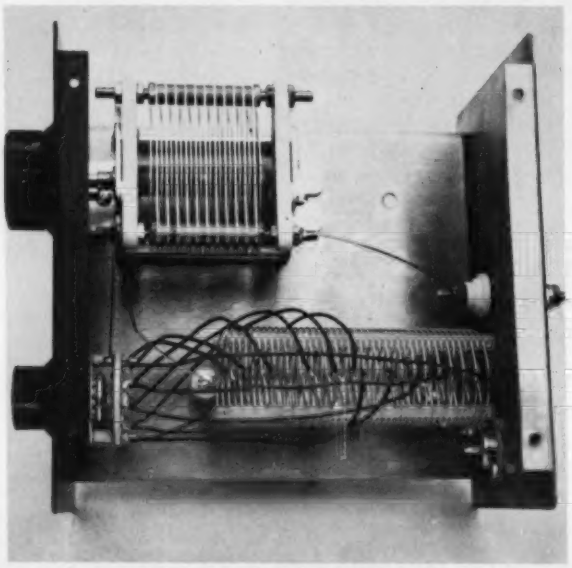
The matching network is larger than the companion R4C and T4XC transmitter and receiver series, but not big enough to present a problem in most shacks. The controls are well laid out with a solid feel (the bandswitch leaves no doubt when it's engaged), and the tuning controls are large and operate smoothly.

Although designed for coax cable, the MN-2000 can handle open wire feeders with the use of a balun, and it worked fine with random wire antennas as well. The network is fairly broadbanded once tuned, allowing you to go as much as 100 kHz without touch-up. Tune-up can be a really quick procedure – if you take the time to tune each band and antenna, and draw up a chart plotting proper adjustment of the resistive and reactive tuning controls. The MN-2000's swr bridge uses a minimum of switching, with a spring-loaded sensitivity control doubling as a switch for forward calibration. The wattmeter is broken down into two ranges (200 and 2000 Watts) on the 3" by 2½" meter scale.

Some other features of the MN-2000 include its ability to put 2nd harmonics down 25 to 35 dB (thus helping to reduce TVI problems). I checked Drake's claim on harmonic attenuation by tuning for the 2nd harmonic on my station receiver (a Drake R4B), and sure enough, the S-meter indicated Drake's specs were accurate. Another nice feature is the fact that using the MN-2000, there is no need to retune the exciter when driving a linear amplifier, since the tuner shows a pure 50 Ohm load.

The best thing about the MN-2000 is probably its price. At a suggested retail of $220, Drake is well within competitive limits with other full legal power antenna tuners, in an attractive easy to operate package. *R. L. Drake Company, 540 Richard St., Miamisburg OH 45342.*

Warren Elly WA1GUD
Associate Editor



Guts view of Dentron 80-10 AT. Note 3000 V capacitor spacing.

DENTRON 80-10 ANTENNA TUNER

Back in what are affectionately known as the "good old days," being an amateur was much simpler than it is today. That's especially true when it comes to putting up antennas. Large lots, pastures, and the wide open spaces were the rule. If you wanted a 70 foot tower – no problem. A 160 meter dipole? Just string it up.

For most of us, the situation has changed drastically. Apartments, condominiums, and small suburban lots have made things quite a bit more difficult. Our mobile population and increasing numbers of people have created space problems. Besides, why go to all the trouble of putting up a permanent installation if you're going to be moving in a few months or a year?

Fear not! There is an answer to the antenna problem. It's called the random wire. Having been around at the time of Marconi, it certainly can't be called a new concept. But with the space and time limitations of our society, it's a very logical solution to getting on the air.

So you've strung a wire out the window to the neighbor's apple tree. Now what? You need a tuner. A random wire tuner. The new Dentron 80-10 Skymatcher will fill the bill perfectly. This compact unit handles 500 Watts PEP, more than enough for any barefoot transceiver on the market. (If you're planning on running a full gallon, best bet is an orthodox antenna . . . any type.)

Although the home QTH in the hills of western Massachusetts has more than ample room for a large antenna farm, I tried out the random wire concept by spooling off somewhere around fifty feet of antenna wire and attaching it to a nearby barn. The Skymatcher has no swr meter, but my Ten-Tec Triton IV does, so I was able to get a quick indication of the match. What started out as a horrendous mismatch was soon brought down to 1.1:1 by the use of the antenna matching and inductance controls on the unit. The same was true on other bands. No problem at all.

For $59.50, the Dentron 80-10 is a solidly built little unit. After exposing the guts, heavy duty construction was evident throughout. The inductance control is a ceramic 12 position rotary switch. An SO-239 is provided for the feed from the transmitter, and the wire itself is attached to a ceramic feedthrough. A huge bolt is provided for attachment of the ground wire, a *very* important part of any random wire system.

Besides apartment or home use, the 80-10 is great for operating portable. String a wire between a couple of trees and you're ready to go. The continuous tuning from 3.2 to 30 MHz makes it easy. And don't forget that it can also match a standard antenna system. *Dentron Radio Company, Incorporated, 2100 Enterprise Parkway, Twinsburg OH 44087.*

Stan Miastkowski WA1UMV
Associate Editor

THE KENWOOD TR-7400A 2m TRANSCEIVER

The recent growth of amateur radio has not gone unnoticed in the sales departments of major manufacturers. Conventions are being broken as companies devoted to VHF equipment move into the HF market, and vice versa. The relative price of equipment is being forced down where the competition is especially tough, and the prime battleground is 2m FM.

Surveys have shown that more than half the licensed amateurs here in the US are on 2m FM. Repeater frequencies are as valuable as gold in the big cities, and the situation is getting worse even in rural areas. More than 3000 repeaters are listed in the new 1977 *73 Repeater Atlas* (available now from Radio Bookstore, Peterborough NH 03458), and with recent FCC proposals to deregulate repeaters under consideration, the situation is bound to burst wide open.

Whatever the results, it's logical to predict that the new generation in repeater operation will grow out of 2 meters, with increased emphasis on crossbanding. Amateurs will probably be left with the decisions on what goes where, and it seems likely

Continued on page 84

Dentron 80-10 AT random wire tuner. Size is compact: 7" wide, 5" high, and 8" deep.

James E. Seidel WA6FEI
1066 N. Westside St.
Porterville CA 93257

Pitcairn Island

- - an inside look at VR6TC

All photos courtesy VR6TC and W6HS

Tom Christian VR6TC, Pitcairn Island, is one of the most sought after contacts in amateur radio. Tom is also a very celebrated person in his own right: He is a direct descendant of Fletcher Christian of *HMS Bounty* fame.

Mutiny aboard His Majesty's transport ship *Bounty* occurred just before dawn on the morning of April 28, 1789. Some eight and one half months later, on the 15th day of January, 1790, Fletcher Christian, who was the leader of that mutiny, eight of his fellow mutineers, six Tahitian men, twelve Tahitian women, and one infant child went ashore on Pitcairn, one of the world's most remote islands.

It was there on tiny Pitcairn Island that those twenty-eight people began a new life and a new breed of society to be known around the world as the Pitcairners, descendants of mutiny.

Thomas Coleman Christian, born on Pitcairn November 1, 1935, is the great-great-great grandson of the most famous mutineer in the world. And from what was a British naval disaster came the greatest sea adventure story in Western history. Many books have been written about this historical event and two movies, "Mutiny on the *Bounty*," were made. The latest movie had Fletcher Christian being portrayed by that famous actor, Marlon Brando.

When VR6TC comes on the air, it is no surprise that Tom will be a man in demand: The ham at this end not only gets to log a new country, but will have a momentary trip via amateur radio to a very historical place.

Tom's voice, Polynesian and British in accent, will be recognized almost the first time it is heard. It has a certain distinctive flavor all its own.

If you want something bad enough, and determination is a prevailing factor, you will succeed in your endeavor. In my case, it was a contact with Tom Christian VR6TC, Pitcairn Island.

The QRM, if you have never been in one of Tom's pileups, is absolutely unbelievable. I know, because from the first time I heard Tom until VR6TC was logged, almost a full year had elapsed. Since that day of success, I have talked to Tom on many different occasions. We have had a few schedules and during our many conversations I've learned a great deal about Pitcairn and VR6TC. I spent many more hours just reading the mail while Tom was talking to other friends he has schedules with. He is a very interesting person, even if you're only listening.

Pitcairn is a small rugged island of formidable cliffs of reddish-brown and black volcanic rock. It looms up from the sea in the middle of nowhere to a maximum height of 1100 feet. The island is only two miles long, and about one mile wide. It's about midway between the Canal Zone and New Zealand and some 3300 miles east-northeast of her nearest shipping point, Auckland, New Zealand.

To the south of Pitcairn there is nothing but open sea until you reach the icecaps of Antarctica. Her South Pacific location is latitude 25 04 south and longitude 130 06 west.

As you approach Pitcairn from the northern side, there will be a small indentation in the sheer inhospitable cliffs that surround the island. This will be the famous Bounty Bay, the only landing point for the island.

Bounty Bay is so named for it is only one hundred yards east of the landing slip where the ship *Bounty* was stripped of all usable cargo and material, and under orders from Fletcher Christian himself, set afire and sunk on January 23, 1790, only eight days after the mutineers landed.

Adamstown, the smallest British colony, and the original home of the mutineers, is situated on one of the few relatively flat areas of land on the whole island. It is here, some four hundred feet above sea level and about three hundred feet west of the bay, where all sixty-two inhabitants live, most of whom are also descendants of one of the nine mutineers who landed in 1790.

Shady Nook, a little area on the outer rim of the village, is where Tom, his wife Betty (also born on Pitcairn), and their three little girls call home. This is also the very same piece of real estate where Fletcher Christian and Mi'Mitti (Fletcher's Polynesian mate) made their first home some 187 years ago.

At one end of the Christian home in a small room is where the radio equipment is located for VR6TC. Most of the gear is from America, some of which was donated by the manufacturers several years ago.

Just outside of Tom's home is a 7 kW, 230 volt, single phase, 50 cycle diesel generator. This is Tom's and is used to supply electricity not only for the ham gear, but also the numerous appliances in the home when the community generator isn't in use.

The island had a 70 kVA, 230 volt, three phase, 50 cycle diesel generator, but something of an unknown nature happened and in June of '76, it went up in smoke

and thirty foot flames. A total loss. It has since been replaced with a smaller unit.

The community generator is only operated from sundown to 11 pm, and this leaves a big gap where no electricity is available. This is why Tom has his own generator and so helps keep VR6TC supplied with electricity.

I asked Tom one time what it costs for diesel fuel to run the generator. His answer sure made me appreciate fuel prices in the United States.

"We purchase diesel fuel in forty-four imperial gallon drums at a cost of $100 per barrel, plus $30 per barrel for shipping and $17 per barrel as a deposit. Fuel is expensive to obtain."

At $2.67 for each gallon of diesel (U.S. measurement), I wholeheartedly agree that electricity gets very expensive to produce on an island as remote as Pitcairn.

Tom's generator has been unreliable for quite some time and has had many problems. It isn't a complete unit but it is made up of parts from here and there. Belt-driven from a separate motor, the performance could stand much improvement.

Dr. Charles "Mert" Moser W6HS, a very close friend of Tom's, felt that the generator couldn't be relied upon to ensure VR6TC stayed on the air. With so many amateur radio operators around the world and Tom being the only operator on the island, something should be done to guarantee electricity to keep amateur radio alive on Pitcairn.

W6HS, through contributions, collected $2,500 and purchased a new generator for Tom. It is on the island now and has been installed. Contributions were sent in from all over the U.S. and some foreign countries, most of which were other amateur radio operators, but not all. Would you believe that amateur radio transmissions are monitored by the FCC? Well they are, and an FCC monitoring station sent a contribution for this generator fund. On behalf of VR6TC and all of amateur radio, we thank you.

Tom Christian VR6TC at his amateur radio station on Pitcairn Island, South Pacific. From here, in the past twenty years, Tom has made contact with nearly every country in the world. He is very well-known and one of the most popular operators on the airways; he is also one of the most friendly. The equipment is Hallicrafters: to the lower right is the driver and to the left is a linear. On top is the receiver. The two small units on top of the driver are a rotor indicator sitting on an electronic keyer. Tom very seldom uses the keyer. He says, "I like my straight key a lot better." VR6TC has three schedules each week with other operators in the States. "Calling up a fellow ham in the United States is almost as easy," Tom says, "as dialing a telephone."

A wind generator was sent to Pitcairn in 1975 to help charge a storage battery power supply that Tom purchased from Australia. The batteries supply electricity of 110 volts for electric lights and a few appliances that will operate from a dc source. The battery supply can't be used for the ham gear because all the equipment is wired for ac use only.

Tom told me one time that he has a 110 volt dc to 230 volt ac converter, but it isn't a reliable unit. He said that he will use it only in case of an emergency.

If something breaks down, and it does occasionally, you don't call a repairman. You fix it yourself. After all, the nearest repair service is over three thousand miles away, by sea. Tom has become very efficient, which is understandable, in the repair of both mechanical and electrical problems.

One morning VR6TC was almost thirty minutes late for a schedule. "My receiver was completely dead this morning," Tom said, "and it took a few minutes to locate and repair the problem."

Many of the homes on Pitcairn are connected by a telephone system so someone can be contacted if the need arises. This system was installed by the islanders as are all other equipment and services on the island.

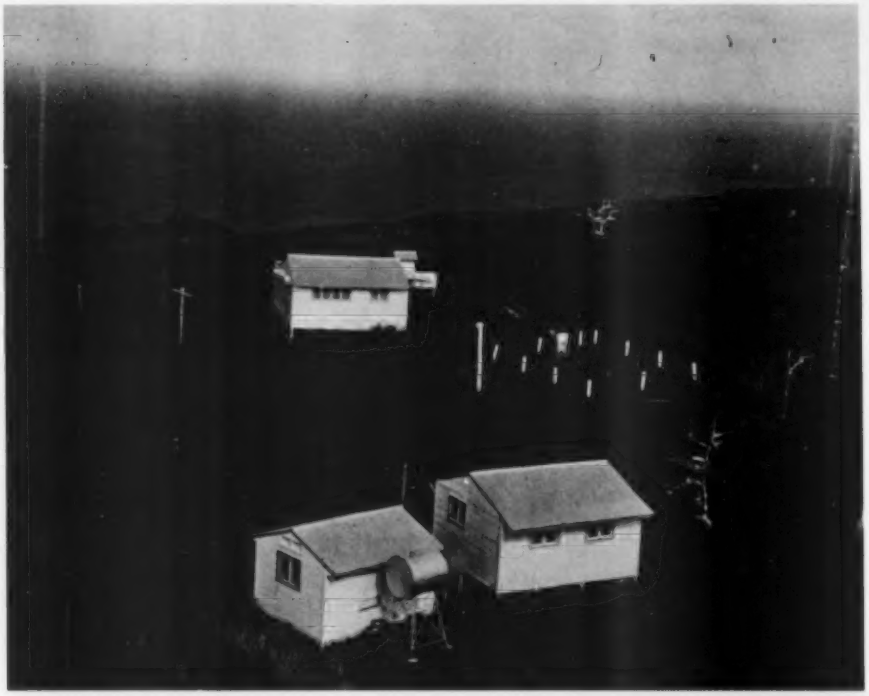
During a QSO one day, Tom received a phone call and was informed that the generator for the dispensary wouldn't start up. He left the air for less than an hour and then returned. All was OK; generator repaired.

If you happen to be listening to VR6TC and he suddenly goes off the air, grab a cup of coffee and QRX; he will be right back.

One time his sister Thelma, who lives next door, started up her washing machine and the circuit breaker kicked out on the generator. Tom was back on the air in short time. I guess amateur radio, at least this time, had priority.

Tom's VR6TC station is Hallicrafters equipment — a receiver, driver, and linear. Maximum output is 1 kW. Although the station is capable of more power, Tom said that he normally runs a maximum of five hundred Watts.

At one corner of Tom's home stands a forty foot wooden pole which has been cemented into the ground for support. Three feet above the



Pitcairn's radio station "ZBP" is situated at Taro Ground, 870 feet above sea level. Three of the seven steel 60 foot towers for the rhombic antenna system can be seen. The building in the foreground left houses the diesel generator which supplies electricity for the station. The building to the right is a storage shed. The one in the background is the station itself. The white markers to the right are the posts of the wire enclosure where the meteorological instruments are kept. The station is commercial and is operated six days each week by either Tom Christian or a staff member.

pole is a three element tri-band antenna. The system was put up about ten years ago. "The pole," Tom said, "has deteriorated so badly from the weather that it is unsafe to climb."

The antenna rotor indicator quit working and Tom has to stick his head out the window to see what direction the antenna is pointing. At night, he uses a flashlight.

Tri-Ex Tower Corporation heard about Tom's problem with the wooden pole and how unsafe it was, and they have very generously donated a new THD-354K, fifty-four foot crank-up tower to him. It should be arriving on Pitcairn any day.

Arrangements have also been made to ship a new rotor unit and tri-band antenna along with the tower unit. This will certainly ensure that VR6TC will remain on the air.

On March 23, 1955, Tom received his first amateur radio license in Wellington in the form of a New Zealand certificate. In 1957, exact date unknown by Tom, he received the VR6TC call for Pitcairn Island. Before Tom received even that first amateur radio license, he spent some time off the island.

For three years, Tom went to school in New Zealand, where he studied meteorology and radio communications technology. These studies enabled Tom to fulfill the requirements for the job he had held for the last twenty years: Pitcairn's Radio Officer. That schooling also earned Tom a 1st class radio telegraph operator's license for both coast and marine operation.

That 1st class license landed Tom a job with the Union Steamship Company for about a year. He worked as a radio officer aboard a passenger ship. While he was telling me this, he said, "While aboard one time during a run, the ship ran aground with about 450 passengers. Although no one was injured, it was quite an exciting moment."

I never did ask Tom how that accident happened, but I'm sure it was just one of those things that fate played a part in.

Upon return to Pitcairn, Tom was now qualified for setting up and maintaining the commercial radio station on the island.

Taro Ground, the location of "ZBP," Pitcairn's radio station, is a mile and a half from Adamstown by steep dirt road at an elevation of 870 feet. The equipment is British with a power output of around five hundred Watts. The large antenna system is of rhombic design situated on seven sixty foot steel towers. Tom maintains all equipment, which he also installed.

The radio station is under British authority with the administrative headquarters located in Auckland, New Zealand. Cablegrams, on an international basis, are received and transmitted on an average of one hundred per month. All traffic from "ZBP" is by CW mode.

Weather reports are transmitted twice daily. Ships at sea are contacted by radiotelephone from the marine radio equipment, also at the station. Any distress signals at sea can also be received here at this location.

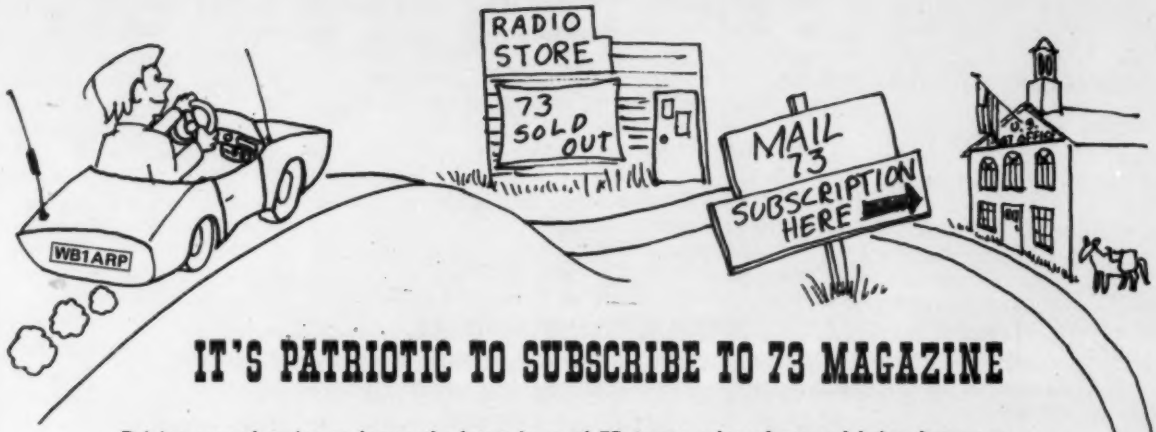
"ZBP" is in contact with headquarters in Auckland each day. If a ship is scheduled to depart a certain country, which will later head for Pitcairn, Tom will be notified. In this way, the island people will know the approximate date of its arrival and can prepare to meet it. Sometimes, up to two months advance notice has been received.

Meteorological readings are taken on a regular schedule each day from a special area just outside the station building. The following are the results:

Annual rainfall is from 60 to 70 inches. Maximum summer temperature is around 86 degrees, with an average of 75. Minimum winter temperature is around 52, with an average of 64 degrees Fahrenheit.

That is typical South Pacific weather with ideal temperatures. The wind is generally mild, from 11 to 15 mph. Hurricanes are extremely rare, but have been experienced. I heard Tom recall a very windy day where a home had the roof blown completely off.

The radio station is maintained each day except Saturday (which is the Sabbath) by either Tom or one of his personally trained staff members. Since all traffic from the station is by CW, I was curious as to the code



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speed requirement for the staff. Tom's reply was not only interesting, but informative as well:

"Most of the CW traffic by other operators is on an average of twenty words per minute. I require any person on the island who wishes to apply for a staff position to take a code test. The test will be for ten minutes at a speed of twenty-two words per minute. Only two mistakes are allowed during that ten minutes."

Six months ago, six British engineers arrived on the island for a special project in Bounty Bay. Their job was to extend the jetty in the bay out at least another thirty-three feet. This was done in an effort to make the entrance safer. The surf is treacherous and breaks relentlessly against the cliffs. Rocks were blasted out of the bay and large steel pilings were driven down in place. Rocks were then piled around them.

By the time you read this, the project will be done and Tom will have more time for amateur radio. His working on the bay project with the other men on the island has left very little time for ham contacts.

I know that a large number of operators have heard Tom, but never had a chance to make contact; some have never had the chance to even hear him. I asked Tom if a special day could be set up for publication and he agreed. VR6TC will be on the air for this special time as well as other times.

VR6TC is on every Tuesday at 2230 to 0100 GMT at 21.350 MHz. The *special* date is Sunday, April 10, 1977, at 1630 GMT at 14.300 MHz. It's possible that he may be on the following Sunday as well, but those mentioned are confirmed. Good luck.

The road from the village to Taro Ground and the radio station is long, steep, and a very tiring walk. Tom, in 1966, purchased and introduced the very first motorbike on Pitcairn. Now the trip is made with greater ease and speed on those twice daily schedules. Betty also has a motorbike. In fact, there are almost forty of them putting around on the island, as well as two Mini Moke cars. Why walk when you can ride, even on an island as small as Pitcairn.

Tom and Betty, a few years ago, took off on the motorbikes to go fishing. It was a nice clear day, but before they could get back, a rainstorm began. The dirt roads turned to gooey red mud and on the way back an accident occurred.

People on Pitcairn are no different than you or I and sometimes go barefoot. On this day, Tom was barefoot and the bike slipped in the mud and his toe got caught in the spinning chain. The rest you can visualize: Tom is now missing half of one big toe.

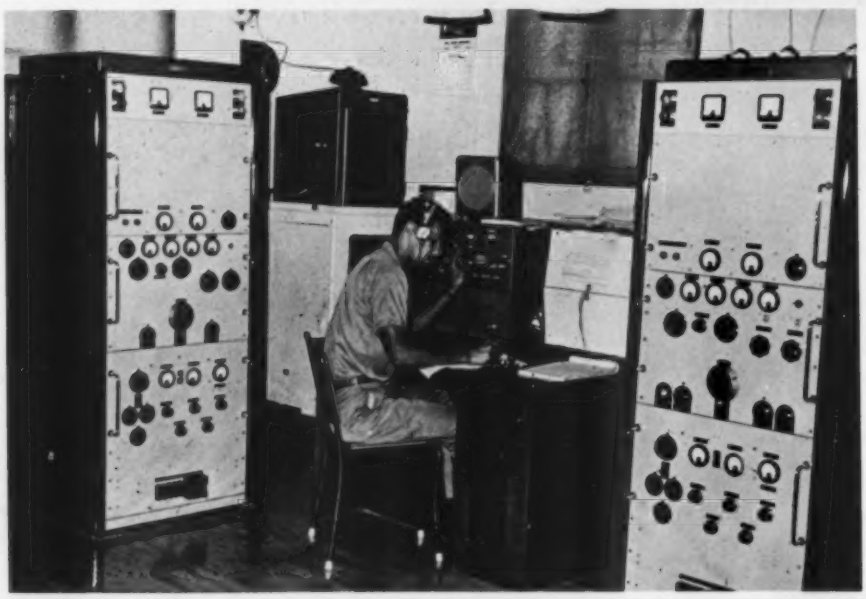
Probably the most feared ailment anyone on the island could encounter is appendicitis. While Tom was in New Zealand, one of his two sisters had an attack of appendicitis and a ship at sea was contacted by radio. Before the ship could get her to New Zealand, she died. "It was quite a shock when word reached me." Tom told me about this not too long ago. What he didn't tell me was that he too had been stricken. I found out during my research for this article.

One day on the island several years ago, Tom too had that terrible pain in his side and he knew exactly what it was. Every household turned its refrigerators up to the maximum setting and made as much ice as possible. Tom was packed in the ice and a ship was contacted from the radio station. The ship arrived, but had no doctor. Tom was taken aboard and kept in ice for the eight day trip to New Zealand. He was one of the few who were fortunate enough to survive. The world of communications again had been needed and proved to be an appreciated treasure.

In the year 1967, one year after Tom and Betty were married, they both came to the United States, where, for about eight months, they were residents of California.

Tom had come here to further his training in radio communications at the Voice of Prophecy, international radio broadcast center of the Seventh-day Adventist Church, located in Glendale CA.

Here he met Eddie Pullen WA6ECC, chief engineer for the VOP and operator of the ARC station K6DTT. VR6TC and K6DTT are in contact each week via amateur radio and these two friends exchange events of here and there. Eddie Pullen also helps Tom and the people of Pitcairn when certain items are needed on the island. With no department store on the island, it takes a long time to get much needed items. Amateur radio reduces that waiting time to half.



Tom Christian on duty operating Pitcairn's radio station "ZBP." The equipment is British with a power output of about five hundred Watts. Tom operates, maintains, and installed the station. Two daily overseas schedules are kept with Auckland, New Zealand. Cablegrams on an international basis are received and transmitted on an average of one hundred per month. The marine radio, also at the station, is used to contact ships at sea, some of which stop at Pitcairn. All traffic from "ZBP" is by CW mode. Tom and Betty both have a code speed of twenty-five words per minute.

Tom also met Dr. Moser W6HS, who so generously set up the fund for the previously mentioned generator. Dr. Moser, called "Mert" by everyone, is a PhD professor at the University of Southern California. Tom and Betty were house guests of Dr. and Mrs. Moser for several weeks. VR6TC and W6HS also have a weekly schedule via amateur radio, now that Tom is back on the island. Dr. Moser on many occasions had made medical *housecalls* for Pitcairn via amateur radio. One of them will be mentioned a little later.

While Tom was in the States, he did a personal appearance tour with the MGM movie, "Mutiny on the *Bounty*." He also appeared on the TV show "To Tell the Truth." Not one of the four panelists guessed that he was the real Tom Christian, descendant of Fletcher Christian of *HMS Bounty* fame.

Tom has relatives in New Zealand, Australia, Norfolk Island, the state of Washington and, of all unlikely places, my home QTH.

For more than two weeks, Tom and Betty stayed at Tom's cousin's home in Porterville CA. Three-quarters of a million amateur radio operators around the world would jump at the chance for a face to face QSO with Tom and here he was, only six blocks away from me, and I didn't even know it. You can't win 'em all.

I had a schedule with VR6TC about two weeks after I found out about the above. During the schedule, Tom's cousin, Beverly Lowe, and her husband Harry had a ten year reunion with Tom and Betty Christian, thanks to amateur radio. It really is a small world when amateur radio gets involved.

Although VR6TC is the only license issued to a member of the Christian family, there were others who operated from Pitcairn before Tom. Floyd McCoy VR6AC and Andrew Young VR6AY both operated from Pitcairn over thirty years ago. Some of you old-timers may have a QSL card from one of these hams, both of whom are also descendants of the *Bounty* mutineers.

More than 20,000 QSL cards have been mailed from Pitcairn with VR6TC imprinted on them destined for every corner of the world. If you made contact with VR6TC, sent a card but never received an exchange, there could be a definite reason.

Pilferage of mail has been known to occur with letters and packages sent to and from Pitcairn. Certain items which Tom knows were sent never reached their destination. Where they went astray is anyone's guess. For any QSL card that Tom received – if he has it confirmed – a VR6TC card will be or has been sent in exchange.

Remember, Pitcairn is a distant and very isolated island and the shipping to and from there is on a one to two month basis, sometimes longer. The mail will pass through several hands before its final destination is reached.

If the weather is bad, ships have been known to bypass the island, even when they carried much needed supplies for the island, including mail. This means that it could take several more months before that mail is finally delivered and the mail on the island is picked up. Several years ago, an incident occurred which was responsible for the loss of many QSL cards leaving the island for their worldwide distribution.

The only entrance and exit for Pitcairn is from Bounty Bay in one of the island's 38 foot long, 9 foot wide diesel-powered whaler type longboats which are built on the island. They are capable of carrying up to 5 tons of cargo and are the only method the people have of getting out to the ships for transfer of cargo and mail.

On June 23, 1972, one of the longboats attempted to take a supply of mail out to a waiting ship and pick up cargo for the island. The seas were violent and the longboat was caught by a large wave and capsized, spilling all the men overboard, and also the mail. Half of those men were injured. The most serious was Tom; the boat had landed on top of him.

"I almost lost my life but managed to make it to the rocks. From there," Tom said, "I crawled toward the landing. My right leg had been broken and the left one was severely bruised."

Tom clung to those rocks for a half hour before anyone could get to him for rescue. He was taken to the island dispensary and the leg was set. A few months later, when the leg didn't heal properly, he went to New Zealand and into a hospital; the leg had to be broken again and reset.

The cargo of mail which spilled overboard when the accident happened contained a large number of QSL cards; they sank to the bottom of the bay.

If by chance you had sent Tom a QSL card prior to that date and never received one in return, yours may have been one lost at sea. Send another one; I'm sure Tom will be very happy to reciprocate, again.

"QSL information is Tom Christian, Box 1, Pitcairn Island, South Pacific." Tom has given that VR6TC contact information a thousand times over. When he gives it to you, a few tips will get a QSL card back a little faster. The envelope will also have a very rare Pitcairn stamp on it.

The U.S. Postal Service now charges 42 cents for a single IRC. One of them is worth only 10 cents on Pitcairn. It costs Tom 35 cents to mail your card back to you. That means you would have to spend $1.68 for IRCs to help Tom pay some of the postage. Save some money and slip a single dollar bill into an envelope with your QSL card and a self-addressed return envelope. That little extra change will help Tom to defray some of those expensive fuel costs to produce electricity for amateur radio's VR6TC. I'm sure he would appreciate the kindness and you will save, also.

When you mail everything, be sure to use a dark colored envelope so the contents can't be seen. Send it *air mail*. This way it will be flown to either the Canal Zone or New Zealand, the only pick-up points for mail going to Pitcairn. If sent by surface, it will wait in some port for the next ship going to one of those two locations. That could cause an additional delay of several months.

The engineers on the bay project took a special survey at the request of an unknown company in Tahiti. It was to determine the possibility of constructing an airstrip of about 900 meters (2,952 feet) on the island. As Tom put it, "It would require the moving of mountains." He did say that it was possible for a 600 meter runway, but no further information was available. Someday it might just be a few weeks before an exchange of QSL cards is possible instead of the current time of up to six months.

Tom and Betty Christian have three girls: Jacqueline Beth, born January 8, 1971, Raelene Kari, born January 28, 1974, and Sherileen Teresa, born December 1, 1975; all are on Pitcairn.

Tom has been asked several times when he will come to the U.S. again. His answer is almost always, "With Betty and the small children, it would be very difficult to get away."

Tom is under contract to operate station "ZBP," but has been heard several times to say that he isn't sure he wants to sign another 3 year contract. Just before Christmas I asked him what the possibility was of him coming here again. This was his answer: "A new contract would compel me to stay here on the island, but I'm

Tom and Betty Christian amongst the numerous tropical fruits which grow in abundance on Pitcairn Island. Tom is holding a breadfruit, the plant which in turn brought about the existence of the descendants of mutiny and the people of Pitcairn Island.

not sure if I want to be tied down. If possible, I may go on a trip of about 6 months starting in June of '77. Very much thought is on visiting the States again, soon."

I would be wrong if I attempted to say that Tom *will* come to the States. Only time and Tom himself can do that.

"Amateur radio is a break from the normal life and a chance to sit down, relax, and talk to friends in other parts of the world." Those are Tom's words and feelings in conversation one day. Public service also gets involved, especially on an island as small and isolated as Pitcairn.

We take for granted the medical services available to us, since we live in a country where a hospital and doctor are always close at hand. On Pitcairn, there is no hospital or doctor, only a small medical dispensary.

It is a requirement that the wife of the Seventh-Day Adventist pastor (who serves a two year tour of duty on the island) be a registered nurse. She is the medical officer for the island. Her qualifications are excellent, but sometimes an illness can reach into the field of an M.D.

On Thursday this past August 12th on 14.225 MHz, I was waiting for VR6TC to come on frequency for his regular schedule with W6HS. It was almost 15 minutes before Tom was due at 1600 GMT when I heard VR6TC call for W6HS; no answer. Another station answered and I heard Tom state that he was calling early because of a possible emergency on the island. Pastor Newman was very sick with a temperature of 104 degrees and had been this way for several days.

Since W6HS was still not on frequency, I gave him a long distance phone call and told him of the above. He got on the air immediately.

After a short discussion between Tom and Dr. Moser, a colleague of Dr. Moser's was contacted who specializes in respiratory diseases. A phone patch connection was provided by John Stagnard W6MAB for Dr. Dickson Young, Beverly Hills CA. The results were a 4,500 mile housecall via amateur radio.

Dr. Young talked to Tom and the nurse on the island for several minutes. They explained Pastor Newman's symptoms and what medication had been administered.

Diagnosis: viral pneumonia. Recommendations were made for additional medication from what was available in the island dispensary. The following week I heard Tom say that Pastor Newman was very much improved and could now get out of bed for extended periods of time. Today, Pastor Newman is in New Zealand and is very healthy.

Pitcairn Island is a unit unto itself, isolated by a stretch of empty sea. Amateur radio is a vital link to the outside world and plays an important part in the lives of every person on the island. Without amateur radio ... ■

EDITORIAL BY WAYNE GREEN

from page 22

CBers into the hobby which reversed the ten year license downward trend.

Few authors like to have their articles rewritten by magazine staffers, particularly when major changes are made. Other than correcting grammar and spelling errors, *73* publishes just about all articles as they come from the authors ... and in this respect *73* seems to be unique in the field.

Few of us are wealthy enough so we can afford to flat give away the enormous amount of time and work (not to mention the expense of photographs) that it takes to prepare an article for publication ... plus later proofreading of galleys and then answering of reader questions. While most articles pay only about $100 to $300, this still takes a lot of the sting out. And it is the amateur who benefits from adequate author pay in the long run, for paid authors tend to keep writing, and unpaid ones tend to find better things to do.

Right now microprocessors are of high interest to *73* readers, but what will be next? *73* called the turn on SSB, on RTTY, on SSTV, on transistors and ICs, so keep watching: Whatever it is, it will be in *73* first.

As an author, then, you are interested in placing your article where it will get the best readership, where you'll get the most money for it, and where it won't get mangled by some "editor" who doesn't really understand what you've written. How do the four ham magazines shape up in these respects?

On the payment end of things, we seem to have *73* on one end, paying the highest dollar for articles ... and paying upon acceptance (which means right away). The other magazines range from somewhat less pay, to very little and wait a year or so, down to no pay whatever.

Readership? You probably have this figured out ... one magazine is aimed mostly at contesters ... another at engineers ... and one seems to be largely going to libraries these days. *73* has been reaching both the active old-timers and the newcomers ... it's where the action is.

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Tempo 130A30	30W	130W	$189.	Tempo 80A02	2W	80W	$159.
Tempo 130A10	10W	130W	$179.	Tempo 50A10	10W	50W	$ 99.
Tempo 130A02	2W	130W	$199.	Tempo 50A02	2W	50W	$119.
Tempo 80A30	30W	80W	$149.	Tempo 30A10	10W	30W	$ 69.
Tempo 80A10	10W	80W	$139.	Tempo 30A02	2W	30W	$ 89.
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Tempo 70D02	2W	70W	$270.	Tempo 10D02	2W	10W	$ 85.
Tempo 40D10	10W	40W	$145.	Tempo 10D01	1W	10W	$125.
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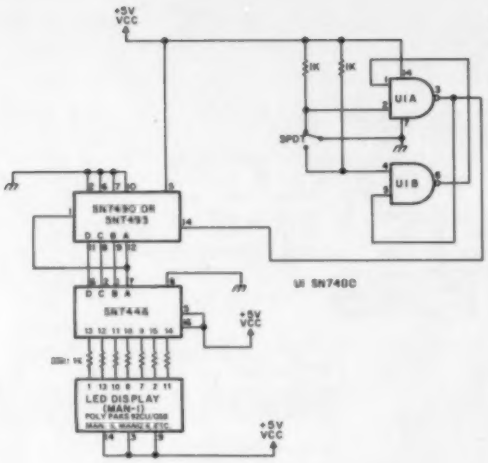

Fig. 1. Basic counting test circuit.

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Denville NJ 07834

How Do You Use ICs?

- - part VI

Before leaving the wonderful world of counter displays, there are several other ICs which you should know about. Not that they are especially useful, but they sound as if they were, and you might be able to use them.

Specifically, there is the SN7492 divide-by-twelve counter and the SN7493 4-bit binary counter. They don't really sound promising, but they must have been built for something.

The first looks the most promising, as if it remotely had something to do with time, and the other is just there. However, for a reason which will become obvious, we will start with the second.

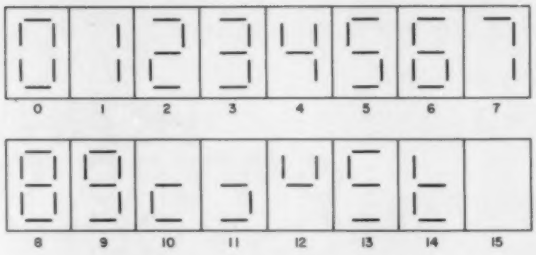


Fig. 2.

Before plunging in, review Fig. 1. This is the schematic of one counting digit using the SN7490 decade counter. This test circuit will count from one to ten (zero).

In particular, notice the A, B, C, and D outputs and how they connect to the SN7446 decoder/driver. The pin connections for the SN7493 are exactly the same as for the SN7490 (except there is no nine reset circuit), so you can just substitute one for the other with no changes. Now you see why it comes first.

But what does it do? With this hookup it counts to 16. This will take a bit of explaining. The first thing you want to know is how to count up to 16 with just one digit. It can be done. It's weird, but it can be done.

The key to understanding actually lies in the decoder/driver and the readout IC. In most applications, the decoder/driver is only called upon to count up to ten, but the circuitry is built in to decode up to 16 pulses. The next problem is how do you display a count of 16 on a seven-segment readout designed for zero through nine count?

There is a very simple answer. You cheat. If you look at Fig. 2 you will see how it is done. They simply chose arbitrary combinations of segments for the additional figures. One of the combinations blanks out the readout on that count. You have to be watching for it or you will miss it.

There does not appear to be any normal type of device that uses this feature in amateur use. It appears to be used for some data instrumentation purpose rather than a specific counting purpose.

The SN7492 divide-by-twelve counter sounds like it might be related to a 12 hour type of thinking. It is, but not directly.

Notice in Fig. 3 that the pin connections for the 7492 are not the same as for the other two ICs. The B, C, and D outputs are not the same pin numbers. Apart from these changes, the circuit is the same for the rest of the test circuit.

When in place, the inclination would be to assume that it would count from 1 to 12 in the same manner as the 7493 counted from 1 to 16. Not so.

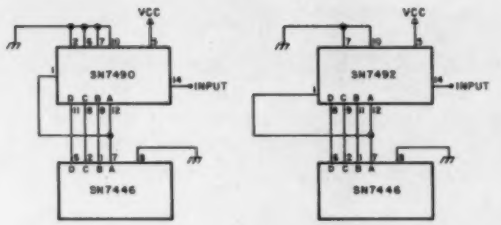


Fig. 3. Note A, B, C, and D pin connection differences.

To understand this, refer to the logic tables in Fig. 4. This is the table of the coded output for each number of pulses that gets fed to the decoder/driver.

Notice that they are all the same from zero to five, but after that they are not the same. If you try to go past five in the count sequence with the 7492, you will not get six. So much for its ability to count.

The reason lies in the truth tables. Notice that the output codes for the 7490 and the 7493 are in binary code, the same as they would be written out. They are both binary counters.

The 7492 is not. Its output follows the binary code up to five and ceases to be binary after that. If you look at the table, you will see that six has the binary code of eight, seven has the code of nine, and so forth.

After nine, it goes into the arbitrary segment selections for the higher numbers. This still follows the binary coding, but with the break in the middle, the continuity is lost.

So what can you do with it? Getting back to time, there is an obvious answer. To count seconds, you go from one to ten (zero), but when you get to tens, it goes 57, 58, 59 seconds, one minute. In other words, from zero to five. This is six counts.

The 7492 is also a divide-by-six counter. The trick is to make it reset to zero after the fifth count. This is easy once you know how.

Look at the truth table again. Notice that the output at six is exactly the same as for zero except for the D output. Also notice that the D output does not appear in any of the sequences from zero to five. Therefore, we can do without the D output.

To do this, we lift the D output from the 7492 counter and leave it floating. Then ground the D input pin of the decoder/driver. Now the circuit will count from zero to five.

One obvious application would be to cascade units to get a seconds and minutes readout for an elapsed time counter circuit. This gets you into reset circuits a little more deeply.

Resetting is usually done with logic levels, but in a simple circuit like this one, it's done by grounding (0 or low logic) or ungrounding (1 or high logic) the correct pins.

With the 7492, both reset pins must be high (1) to reset to zero. At least one of the reset pins must be at low (0 or grounded) to count.

With the 7490, there are two sets of reset pins. To reset to zero, both zero reset pins must be at logic 1 (high), and at least one of the nine reset pins must be at logic 0 (grounded)). For proper counting, at least one of each set's reset pins must be at logic 0 (low or grounded). The 7493 is the same except there are no nine reset pins.

This is mostly done for you on the published schematics, but when you roll your own, you may forget to see that those pins are accounted for.

One of the first things to look for when you don't get proper counting action is an error in the basic hookup or the incorrect use of the reset pins.

These gadgets are designed to be compatible, so there is no real problem when cascading them to get a timing readout. Two digits are shown in Fig. 5. Except for the obvious changes in wiring for the two different counter ICs, the circuit is the same as for the regular readout.

The external circuitry would be very similar to what a counter would use. In a simple setup like this, there would be a timing chain derived from the ac line frequency, a gating circuit to start and stop the count, and a reset circuit.

External to the unit would be some method of keying the elapsed time counter mechanically or electronically. Something must tell it when to start and when to stop. There are a wide variety of switching methods depending upon the application.

Still, this is similar to the frequency counter application, and may in fact be somewhat simpler. However, neither of these counter ICs has found wide application in amateur counting circuits. They are, however, familiar in frequency dividing circuits.

Just as the 7490, the 7492 and the 7493 have both been used to get different frequency divisions. This usage was covered in a previous article.

If you have a few of these ICs on hand for frequency dividing, you might try them in this test circuit so that you will know how they behave. Then when you run across them in an application you want, they will not be unfamiliar to you. ■

	7493 DCBA	7490 DCBA	7492 DCBA
0	0000	0000	0000
1	0001	0001	0001
2	0010	0010	0010
3	0011	0011	0011
4	0100	0100	0100
5	0101	0101	0101
6	0110	0110	1000
7	0111	0111	1001
8	1000	1000	1010
9	1001	1001	1011
10	1010		1100
11	1011		1101
12	1100		
13	1101		
14	1110		
15	1111		
	Binary Code	Binary Code	Non-Binary after five

Fig. 4. Logic table.

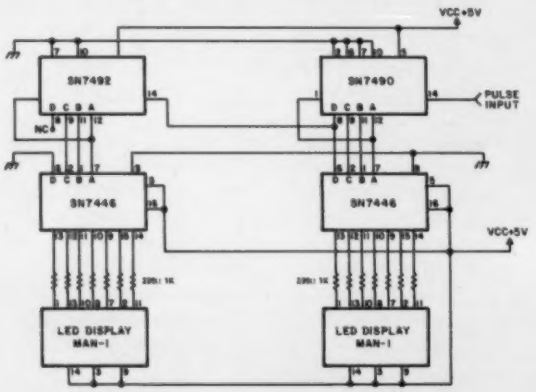
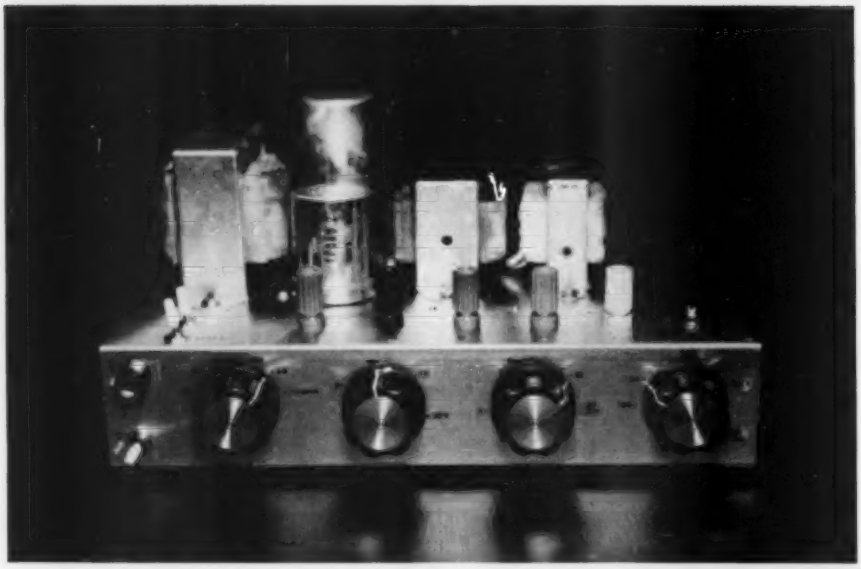


Fig. 5. Sixty event counter (0-59).



Super Low Voltage Power Supply

- - with overcurrent protection

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Islington, Ontario
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The following article was prompted by the many disasters I have had while experimenting with unfamiliar ICs and untested circuit designs. This past year I have destroyed two TRV2000 voltage regulators, one XR205 function generator, two 741 op amps, two 709 op amps, one optical isolator, and so on. Sometimes it happens when the meter probe slips and sometimes it happens because of incorrect design of the circuit. In nearly all cases, however, things burn out because of excessive current drawn for too long a time. The remedy is a power supply that abruptly removes the voltage from the circuit once a preset current is exceeded. I felt this would be superior to the usual type of current limiting in which the power supply delivers a constant current to the load and less voltage once the current limit is reached; the objection to the latter is that the user may not be aware that the current limit has been reached and that the voltage is no longer regulated, especially if it happens for only a very brief interval. A circuit may not operate correctly with the unregulated voltage during this interval and the user would be hard pressed to discover the reason for the malfunction.

Basic Layout

Three power supplies were constructed as shown in Fig. 1. The first is a dual tracking supply with variable output voltage 0 to ±20 volts and current to 100 mA on each output (200 mA total current capacity). Also available is a +12, -6 volt option. Current sensing is done in both the positive and negative legs, and when the current exceeds a preset level, a signal is developed to shut down the output from the voltage regulator. This signal latches so that output voltage can only be restored by pressing a reset switch.

The second supply has variable output from 2.6 to 25 volts and current to 1 Ampere. Up to 34 volts is available at reduced current. This supply also has adjustable current sensing and, like the first supply, the output voltage shuts down when the current exceeds a preset level. Voltage is restored by pressing the reset switch.

The third supply provides a fixed 5 volt output at currents to 1 Ampere for operat-

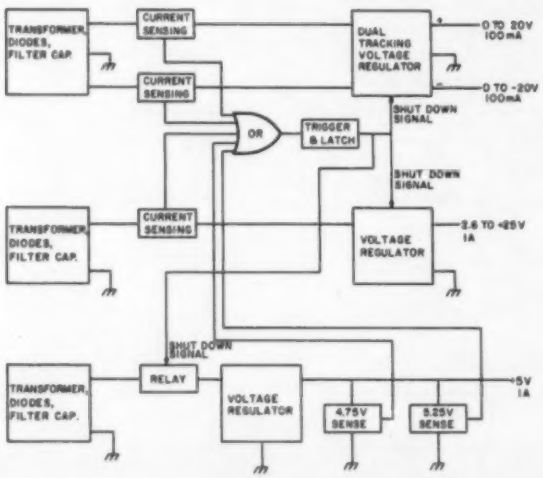


Fig. 1. Basic layout.

ing TTL circuits. This supply has output voltage sensing and will shut down if the voltage moves outside a preset range from 4.75 to 5.25 volts.

The first supply provides the power for the sensing circuits used in all three supplies. Also, if any one supply shuts down, the other two will shut down also.

All three supplies use voltage regulators that are short circuitproof, an added safety bonus in the event that the current sensing circuits are manually disabled or in the event of the failure of some component in the current sensing networks.

Current Sensing

The current sensing network in Fig. 2 operates as follows: Assume that initially no current is drawn from the supply. With R2 set to 500Ω, R2 + R3 = 21k and R4 + R5 = 21k. With the wiper of R4 set closest to R3, the voltage at pin 11 of voltage comparator IC1A will be 14 volts, exactly half the voltage across C1. Assuming for the moment that no current flows in R1, the voltage across R6 and R7 will be 28 volts and the voltage at pin 10 of IC1A will be 14 volts also. When current is drawn from the positive leg of the supply, a voltage drop develops across R1 and the voltage at pin 10 of IC1A drops below 14 volts. This drives pin 13 of IC1A positive and the resulting current in R21 charges C3. Q1 fires, sending a pulse through C4 to SCR1. SCR1 turns on, operating relay K1 and forcing Q2 to switch on. Q2 shorts out R27, thus reducing the output of IC3 to nearly zero volts. K1 interrupts the current to IC6 in Fig. 3. Q1 also sends a pulse to C14 in Fig. 3. This pulse turns on SCR2, forcing Q4 to switch on; this action reduces the output of IC5 to zero volts.

When the load is removed from the output of IC3, the power can be restored by opening S2A and S2B (normally closed switches). By moving the wiper of R4 closer to R5, the voltage at pin 11 of IC1A is lowered. It then requires a greater voltage drop across R1 (more current in the load at output of IC3) to lower the voltage at pin 10 of IC1A so that pin 13 will go positive. Thus the setting of the wiper of R4 determines what current will drive pin 13 of IC1A high.

An identical network consisting of R8 to R14 and IC2 senses the current in the negative leg of the supply. The output of IC2 switches between 0 volts and -26 volts approximately. Since IC1B will not operate normally with any input below -0.3 volts, the voltage from pin 6 of IC2 is divided down by R15 and R17 so that the voltage across R17 switches between 0 volts and -0.25 volts. R16 and R18 form another voltage divider which provides -0.15 volts to pin 8 of IC1B. Thus IC1B switches like IC1A in response to an overcurrent in R14. D5 and D6 form an OR gate, hence isolating the outputs of IC1A and IC1B from one another.

In Fig. 3, current sensing is done in the same manner as described for the positive leg of Fig. 2. Since the maximum current for this supply is 10 times greater than for the first supply, resistance values have been adjusted according-

Bottom view of power supply.

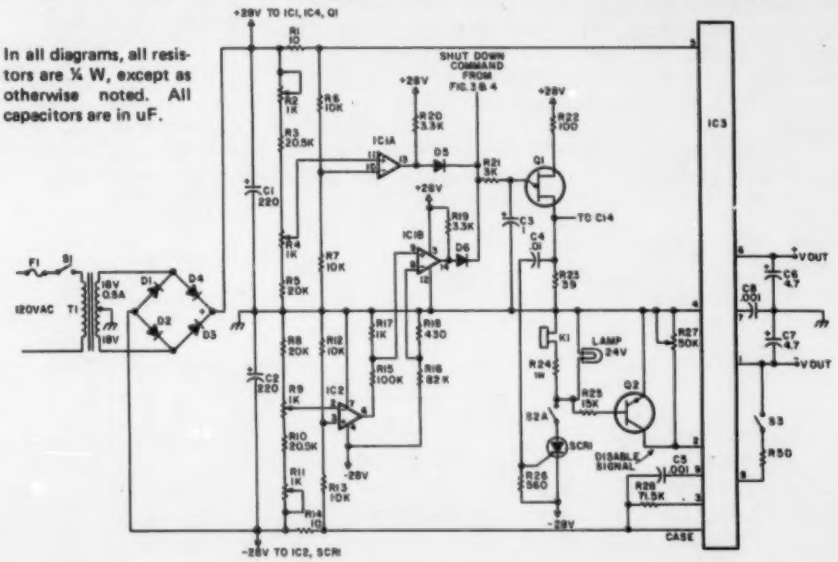


Fig. 2. Dual tracking regulated supply.

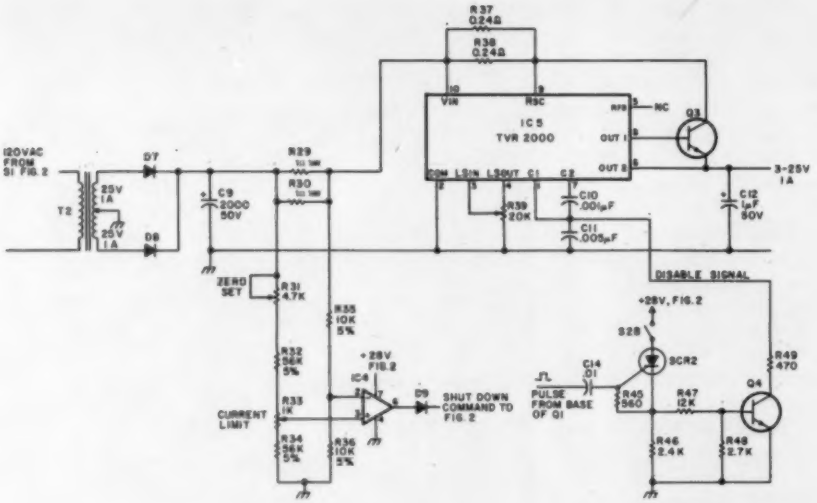


Fig. 3. Variable voltage power supply.

ly. D9 forms another part of the OR gate that feeds R21.

Voltage Sensing

For the 5 volt supply in Fig. 4, it is more desirable to have output voltage sensing than current sensing. This is because there are wide variations in the current demanded by TTL circuits when they are switching from state to state. The current limit point would always have to be set rather high, and consequently only gross overcurrents could be sensed. On the other hand, a circuit that senses when the voltage falls below 4.75 volts, the lower operating limit for 7400 series TTL, is quite useful. Suppose, for example, that you are operating near the 1 Ampere limit of IC6; a brief current pulse could exceed this limit and the internal circuit of IC6 would then allow the output voltage to drop. Without voltage sensing this could easily go unnoticed and your circuit would malfunction.

In Fig. 4, D14 provides a reference voltage. R41 acts as a voltage divider and is set to 5.25 volts. R42 is another voltage divider and is set to 4.75 volts. IC1C and IC1D compare the output of IC6 to these voltages and, if the output moves outside the window from 4.75 to 5.25 volts, pin 1 or pin 2 will go high. This signal goes to R21 of Fig. 2 and eventually shuts down all the supplies.

Response Time

R21 and C3 determine the response time of the circuit. With R21 = 3k and C3 = 1 uF, the circuit responds to an overcurrent, overvoltage or undervoltage that lasts 3 milliseconds or more. K1 adds an additional 7.5 ms to the time required for the 5 volt supply to shut down. By reducing C3 to 0.1 uF, response time can be made as low as 0.3 ms. R21 can be increased to as much as 10 megohms if desired to lengthen the response time, but should not be reduced below 3k.

The Voltage Regulators

The 4194TK regulator is available through advertisers in this magazine. It is internally current limited at about 350 mA when the positive output is shorted to ground. It also has internal thermal limiting that will reduce the output when it gets too hot. A small heat sink is required when the operating current is 100 mA in each leg of the output. In Fig. 2, S3 is normally open. When S3 is closed, R27 can be adjusted to give +12, -6 volts output for the operation of certain types of voltage comparators.

The 309K also has current limiting and thermal limiting. It will provide a little over 1 Ampere when mounted on a heat sink with the circuit shown.

The TVR2000 has been available from Poly Paks for a number of years and is quite inexpensive. It is surprising that in spite of its outstanding performance and low cost I have never once seen it used in a magazine article. Perhaps it is because the information on how to use it is hard to find; the specification sheets that come with it do not give enough information on how to use it. A very complete article on its use in a wide variety of applications can be found in the periodical called *EEE* (Electronic Equipment Engineering), Volume 17, No. 6, June, 1969, pages 82 to 90, available at large libraries. The name of the article is "Voltage-Regulator ICs with Foldback Current Limiting," by D.R. Sullivan and H.W. Mamie.

In Fig. 3, the foldback current limiting option is not used. Instead, simple short circuit sensing is used. R37

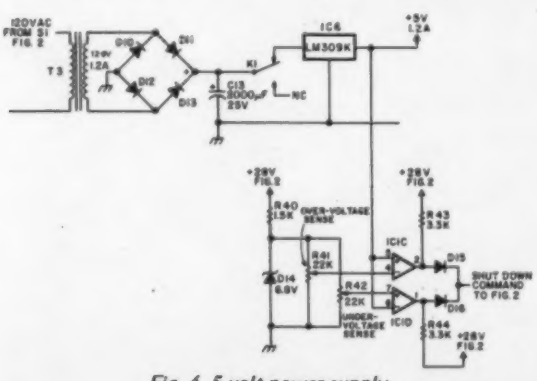


Fig. 4. 5 volt power supply.

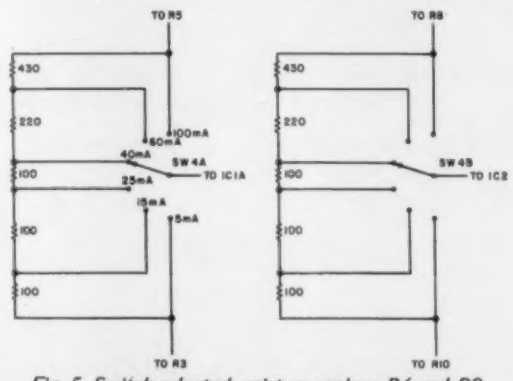


Fig. 5. Switch selected resistors replace R4 and R9.

and R38 set the short circuit current to a value of about 1.2 Amperes. The relationship here is $R_{SC} \cdot I_{out} \approx 0.1$ volt, where R37 and R38 in parallel make up R_{SC}. R39 sets the output voltage. Q3 acts as a current booster and is mounted on a heat sink. C10 stabilizes the current limiting circuitry and C11 stabilizes the regulator section of IC5. Different values from those shown may be required to drive high capacitance loads.

Selecting Resistors

Resistors of 1% tolerance are best for R1, R3, R5 to R8, R10, and R12 to R14. This will make the final adjustments simpler and will keep tracking errors in R4 and R9 to a minimum. In Fig. 3, 5% resistors will suffice for R32, R34, R35, and R36, providing you choose them such that R32 $\leq$ R34 and R36 $\geq$ R25.

Regarding the tracking of R4 and R9: Since they form a tandem control, it is important that they both exhibit approximately the same resistance between their wipers and their ends for all rotations of the shaft. Failure to do so will mean that the positive and negative legs of the supply will trip at different currents. Several dual controls I bought did not track very well. If you want very good tracking, replace both R4 and R9 with a series of 5% resistors and use a two pole rotary switch to select the current limit you want as shown in Fig. 5.

Construction

All three supplies were constructed on a single 4" x 5" printed circuit board as shown in Figs. 6 and 7. IC3 does not plug directly into the board; the holes in the board have been spaced out to assure clean etching. Solder a short wire to the outside of each pin of IC3; insert the wires into the PC board and solder. A piece of aluminum was bolted to IC3 as a heat sink. There are so many connections to the PC board from the external switches, controls, transformers, etc., that it was not possible to arrange for an edge connector on a board of this size; instead there are about 35 wires soldered at various points around the edge of the board and all are routed to one end of the board so that the board can be hinged outward from the chassis if parts on it need to be replaced in the future.

All components fit nicely on a chassis 10" x 6" x 2" as shown in the photograph.

Final Adjustments

Switch S2 to reset. Leave S3 open. This disables the shutdown mechanism. Connect a high impedance voltmeter between pin 7 of IC1D and ground. Adjust R42 for a reading of 4.75 volts. Connect the voltmeter between pin 4 of IC1C and ground. Adjust R41 for a reading of 5.25 volts.

Set the wiper of R33 to the end closest to R32. Connect a voltmeter between pin 6 of IC4 and ground. Adjust R31 so that the reading just goes to zero.

If you are using a dual potentiometer for R4 and R9, proceed as follows: Set the wiper of R4 to the end closest to R3; the wiper of

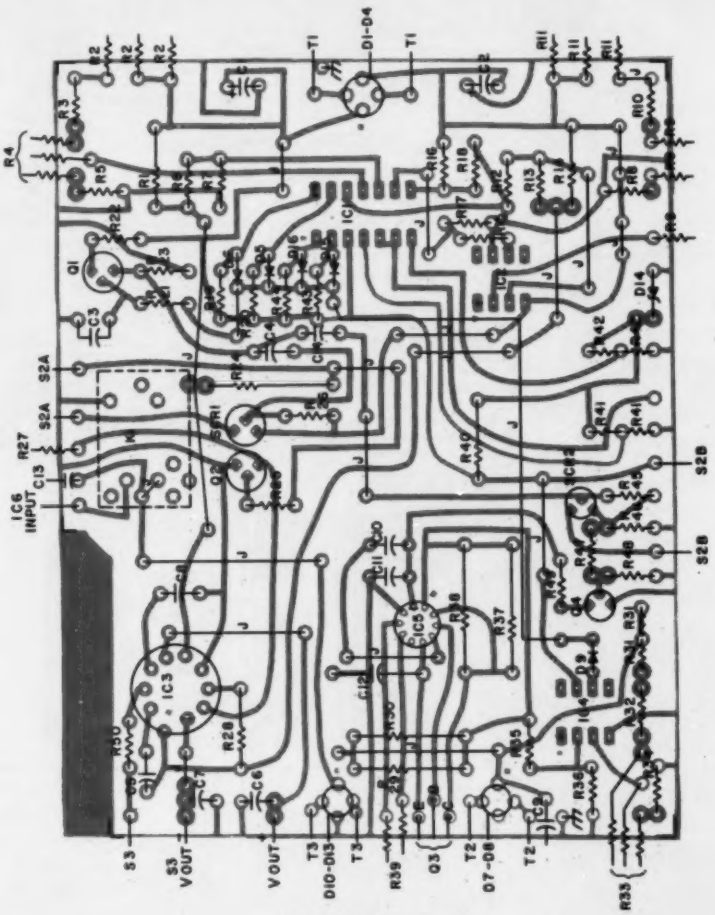
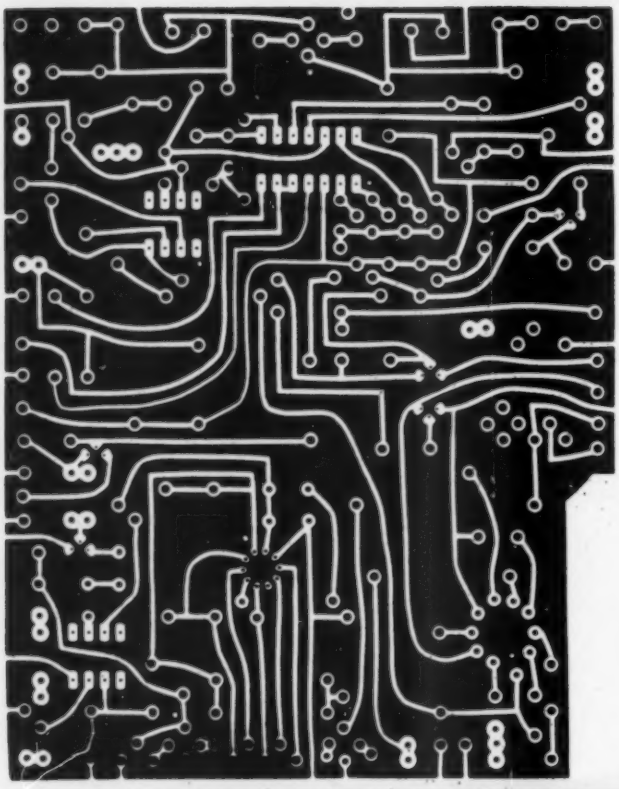


Fig. 6. Parts layout.

Partial Parts List

IC1	339
IC2, IC4	741
IC3	4194TK
IC5	TVR2000 (available at Poly Paks)
IC6	309K
D1-D4, D10-D13	2 A 100 piv bridge rectifier
D7-D8	half of 2 A 100 piv bridge rectifier
D5,6,9,15,16	1N4148
D14	1N957B 6.8 V, 0.4 W zener diode
Q1	2N2646
Q2	2N4249
Q3	MJE3055
Q4	2N5550
K1	ITT type 24A02C18A
R4,R9	dual section control; see text
SCR1,SCR2	C103B

Fig. 7. PC board.



R9 should then be at the end closest to R10. Connect a voltmeter between pin 13 of IC1A and ground. Adjust R2 until the reading just drops to zero. If you run out of adjustment with R2, interchange R6 and R7 and try again.

Connect the voltmeter between pin 14 of IC1B and ground. Adjust R11 until the reading just drops to zero.

If you elect to use the switched resistors in Fig. 4, proceed as follows: Set the switch in Fig. 4 to the 5 mA position. Connect a load between the positive and negative output terminals of the supply and adjust the output voltage so that the load draws 5 mA. With a voltmeter from pin 13 of IC1A to ground, adjust R2 until the voltage just drops to zero. If you run out of adjustment with R2, interchange R6 and R7 and try again. Connect the voltmeter between pin 14 of IC1B and ground. Adjust R11 until the reading just drops to zero. ■

CONTESTS

from page 12

FREQUENCIES:

1810, 3550, 3735, 3900, 7060, 7135, 7235, 14050, 14280, 21050, 21135, 21300, 28050, 28600, 50-50.5, 144-148.

EXCHANGE:

RS(T) and QTH — Wisconsin stations will send their county for QTH; others send ARRL section or country.

SCORING:

U.S. and VE contacts count one point, while DX contacts count 3 points for Wisconsin stations. All others score 1 point per Wisconsin contact. Wisconsin stations are to multiply the total QSO points by the number of ARRL sections and Wisconsin counties contacted (146 max.). KP4, KH6, KL7 and KZ5 count both as 3 point QSOs and as section multipliers. All non-Wisconsin stations should multiply the number of Wisconsin QSOs by the number of Wisconsin counties worked (72 max.). Multi-county portable/mobile operations will keep a single log for the entire operation and will multiply the contact points by the total number of different sections and counties worked.

AWARDS:

Certificates will be awarded to the high scoring fixed, portable, mobile, Novice and VHF stations, in Wisconsin as well as each ARRL section and each DX country. The Neenah-Menasha Club is sponsoring a magnificent traveling trophy to be awarded to the high scoring Wisconsin entry of a club each year. This trophy will be awarded to the club submitting the highest total combined score of its members.

ENTRIES:

A summary sheet and station log are requested. Indicate each multiplier the first time worked. Logs must be received no later than May 6, 1977 (DX logs by May 20). Wisconsin clubs should forward a letter stating the calls of their members whose score counts for their club's total. Club members should be sure to identify their club on the first page of the log submitted. All entries should be addressed to: Kenneth A. Ebneter K9GSC, 822 Wauona Trail, Portage WI 53901. Enclose a business size SASE for notification of results.

1977 MASSACHUSETTS QSO PARTY

Starts: 1200 UTC, May 14
Ends: 2200 UTC, May 15

The contest is sponsored by the South Shore Repeater Assoc., Weymouth MA. No time limit. A station may be worked once per band, CW and phone considered separate bands. No crossband or repeater QSOs permitted. Mass. stations may work each other.

EXCHANGE:

RS(T) and county (for Mass.) and ARRL section (or country) for others.

SCORING:

Count two points for each completed exchange. Outside stations multiply total QSO points by different Mass. counties worked (total: 14). Mass. stations multiply total QSO points by different Mass. counties plus ARRL sections and DXCC countries worked. (Do not include E. Mass. or W. Mass. as sections.)

FREQUENCIES:

CW — 1810, 3560, 7060, 14060, 21060, 28060.

Phone — 1820, 3960, 7260, 14290, 21390, 28590, 50.110, 146.52.

Novices — 3720, 7120, 21120, 28120.

AWARDS:

Suitable awards. Mailing deadline, June 30. SASE for results and awards, c/o R. J. Doherty W1GD8, RFD #1, 14 Pine St., Sandwich MA 02563.

The latest Brazilian amateur prefixes, with thanks to PT2JB. Map courtesy of the Communications Ministry of Brazil.

GENAVE

The HAM Gear for 1977

GTX-IT
Hand-Held 2-meter FM, 6-channel, 3.5 watts hand-held with factory-installed tone encoder

$299.95

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Hand-Held 2-meter FM, 6-channel, 3.5 watts hand-held

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CHECK THESE FEATURES:
- All metal case
- American made
- Accepts standard plug-in crystals
- Features 10.7 MHz crystal filter
- Trimmer caps on TX and RX crystals
- 3.5 watts output
- Battery holder accepts AA regular, alkaline or nicad cells
- Mini hand-held measures 8" high x 2.625" wide x 1.281" deep
- Rubber ducky antenna,
- Wrist safety-carrying-strap included
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- Factory-direct to you!

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- Charger for GTX-1 battery pack
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Plug-in installation on most amateur transceivers.

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INTERMOD? Virtually None!
SELECTIVITY? Really Super
NUMBER OF CHANNELS? From 1 to 22

$239.95 (Incl. 146.94 MHz)

The GTX-202 is adaptable anywhere—at half the price of synthesis—so, buy at low acquisition cost, and add crystals later as you want them.

CHECK THESE OUTSTANDING FEATURES:
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- 30 watts (nom.) output
- 8-pole crystal filter
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73-3

David H. Atkins W6VX
130 N. Westgate Ave.
Los Angeles CA 90049

QLF? Not with the Great Lakes Sideswiper!

- - almost perfect CW

With no apologies due the electronic keyers and the modern keyboard or "CW" typewriters, a telegrapher's "fist" is as individual as handwriting. We observe this, of course, by listening to the other guy.

It can be a pleasure to listen to some hand keying, or it may be almost impossible. For instance, how often do we hear persons sending things like, "My nag is Bobbob"? The Lone Ranger's nag is "Silver." We should remember this the next time we send letters in words that need accurate spacing. This used to be called QSC, meaning "your spacing is bad." The OBCQS, or Official Board for Changing Q Signals, replaced this with QSD for some obscure reason. Still, QSD is one of the rarest and littlest used of all the Q signals.

While on the subject of the OBCQS, someone of course had to take over eventually! Think of conditions that used to exist. When you heard the signal QRL immediately followed by twenty of the abbreviations for "I understand," it was reasonable to assume that the station sending all that was busy. They simply removed the 20 "I understands."[1] See how logical the work of this secret board turned out to be? Now we have just QRL, meaning "I am busy," though inferred is the added information, "Please QRT or QSY or turn your receiver on before clobbering my QSO." I hope the OBCQS has been disbanded for malfeasance, as it loused up a number of things (like "QSB"), so nowadays you have to spell it out to find if your spark is bad.

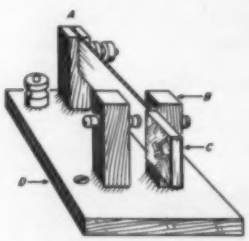


Fig. 1. A: Support for the blade and paddle. B: Posts (parallel connected, or for electronic bug, a terminal for each post). Distance from A to contacts on blade and posts is 2½" (6.3 cm). C: Paddle, to overhang front edge of base D about ½" (1.25 cm). Distance from front end of C to contacts is approximately 2" (5 cm). Dimensions of C, approximately ¼" x 1" x 1¼" (0.6 cm x 2.5 cm x 3.2 cm). Center of paddle to deck, 1½" (3.7 cm). D. Base, 3/8" x 3" x 6" (0.95 cm x 7.5 cm x 15 cm). Front of D to center of B or contacts is 1¾" (4.4 cm). Anti-skid hole in D, same as above.

Now to get back to QSD. Recently I read an article by J. K. Bach entitled "Glass Arm."[2] I would like to confirm his interesting, factual observations regarding this affliction. Many newcomers are so devastated when they realize their spacing is terrible that they go out and purchase a microphone. This usually happens after their friends ask, "QLF?" (This is the unofficial, impolite way of saying "QSD," or "are you sending with your left foot?") The result of going on phone at this point is that when some rude person comes on code with SOS, our phone man answers, "This frequency is in use, you lid!" He cannot read his own call any longer. CW is smoke signals to him.

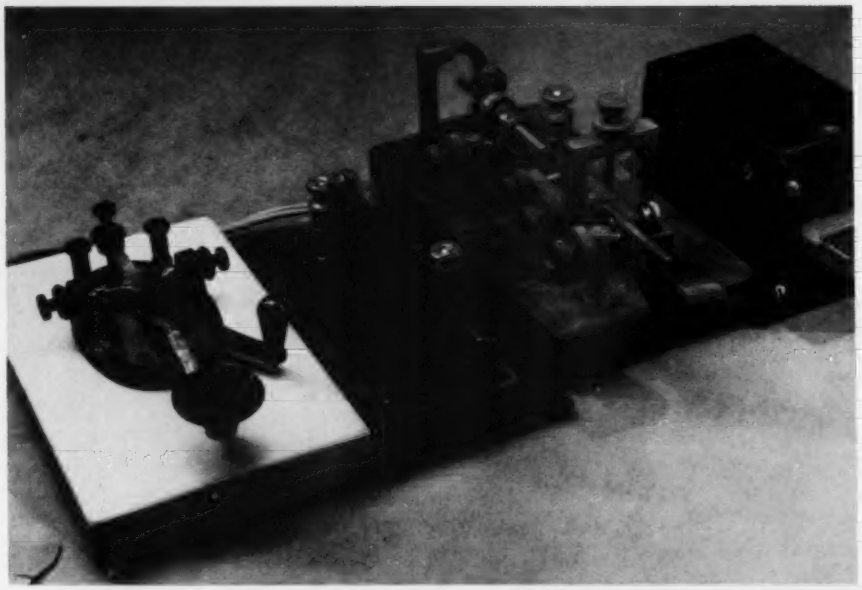
When glass arm set in about two days after I got a ticket to operate, I had to find a reasonable cure. I had a Ford coil going, and no way to get on phone. Some of my peers had built sideswipers (sometimes called cootie keys). They were sailing along at 20 wpm. They had found that running ten Amps through a telegraph key, or most bugs, would cause the contacts to weld closed. So many small silver coins became 20 Amp contacts. Bugs and big fast relays were hard to come by, too. So build a cootie. You never have to worry about glass arm again once you get used to a Great Lakes Sideswiper. But glass arm does last. After reading Bach's article, I loosened the bearings on the straight key and tried his remedy. I could go about 15 wpm fairly well. Above this, QSD. Some good operators can do about 30 wpm on a pump. Not I, alas.

The reason for going into the "fist" aspect of telegraphy is that, as Bach points out, you have to have the right amount of "feedback" (no pun intended). Loosening the bearings on a straight key seems to increase this.

Let's look at the meaning of feedback for a moment. "Once you get the feel of it" is an expression one often hears when trying to get used

to some new experience. Your own built-in servo system has to become accustomed to take the necessary cues from your vision, or hearing, or other senses. The pilot of a boat or plane will readily admit that the autopilot can surpass his ability in the long run. The experienced race driver is in a life or death situation during competition, hanging on the end of a thread which can snap. The ones with the good circulatory ducts and range finding vision live longest. Feedback controls your speech and handwriting and temper and keying – in fact, everything you do while awake or asleep. An interesting experiment in balance is to close your eyes and try to stand steadily on one foot for a moment or two. Sooner or later, if one does not peek, one starts searching for that lost horizon by hopping – to remain upright. Norbert Weiner demonstrated feedback with an automated toy which could move about on the stage avoiding obstacles put in its path. Real magic. Now we have the "sleeping torpedo" lying on the ocean floor waiting for its victims above. We hope it retains its faculties!

The three keys on the left in the illustration are self-explanatory. But that black box on the right is another version of the cootie. It was built to key screen voltage and is shockproof. It may be used as a pump in the position shown. To the left of the home brew bug is my 1921 air-cooled Sideswiper with the 20 Amp contacts. It has been around the world twice with me and still will key a large spark set if you can find one. With it, when a ship rolls to port it will not send a dash of its own as a bug will. This type key is the traditional favorite in rough seas or mobile on rough roads. The tag "Great Lakes" comes from operators there trying to send with one foot on the bulkhead in a storm. You can usually tell who is using one



by the spacing it induces in one's fist. The dots are usually longer than the spaces in between them, and the dashes may be a little uneven. This depends on that "fist."

To send with precision is to learn to turn up the feedback, turn on the code practice oscillator, and listen carefully. If you get used to it, make a tape recording of what you think passes for OK stuff. Now play this back. Horrors, you say? So what's the big technique for improvement?

1. Ungrit your teeth and take a warm bath. Then with the thumb and the next two fingers, lightly grasp the paddle in the space position. Breathe normally. Start at 15 wpm with a few Vs.
2. Start every letter by moving the paddle to the left side.
3. In between letters for the spaces, let go of your light grasp without removing your hand.
4. To send every letter or number, go from left to right to left until the letter or number is completed.

Letter A would be left, – RIGHT.
B: L – r – l – r.
C: L – r – L – r.
D: L – r – l, and so on.
Figure number one: l – R – L – R – L.

Take a few runs at the alphabet and some numbers while recording yourself and try the playback again. Better now?

Stick to the procedure. Very important is #3, the loosening of the grasp between letters. This gives you dash length spaces. Try not to rush through the dot sequences (such as in the letters S and H). When you begin to make errors, *stop*. Weiner's machine got psycho and ran into walls when it was tired out. He had to put it to bed and turn off the lights!

When signals are weak and covered with pulses of QRN or M, any sloppy sending is very difficult to copy. Good spacing will permit much better copy by your victim. This of course goes for all keying and for any speed. This also goes for handwriting or skywriting.

The Sideswiper is no toy. It has been manufactured in the past by Bunnell & Co. of sounder and relay fame. Lately a Scandinavian outlet has been advertising one. You may wish to build your own. The outline drawing gives the dimensions. You can use pieces of Mechano, pieces of hacksaw blades, and angle brackets, plus your imagination.

The fixed contacts may be made adjustable for gap width. A gap on each side of about 50 thousandths of an inch with plus or minus 30 thousandths adjustment (1.0 mm ± 0.5 mm) is best. A wide space is recommended for best inter-dot spacing time. If, after practice, you find the spaces are still too short, a relay adjusted to give a few milliseconds delay may be placed between the key and the transmitter. This remedy is a move of desperation and only complicates things. Practice some more.

The Sideswiper will never replace the bug types as a speed key, but it is a cut above a straight key. You will hear it in use by both amateur and commercial stations throughout the world. With care, a speed of 30 words per minute is feasible. You probably will have a fist that your friends will recognize. If you send poorly, and you have a KX prefix, some guy will turn his beam toward YU land and give you a call. It happens with other keyers, too, however. Whatever key you use, try for good spacing or your NAG will be MUD. ■

References

[1] *Robinson's Manual*, U.S. Naval Inst., 1918, p. 222.
[2] *73*, May, 1976, p. 38.

FCC

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the matter of

Deregulation of Part 97 of the Commission's Rules to simplify the licensing and operation of complex systems of Amateur Radio stations and modification of repeater subbands.

Docket No. 21033

RM-2664
RM-2780

NOTICE OF INQUIRY AND NOTICE OF PROPOSED RULE MAKING

Adopted: December 22, 1976
Released: January 6, 1977

By the Commission: Commissioner Quello absent.

1. The Commission has before it the two above-captioned Petitions for Rule Making, submitted in accordance with the Administration Procedure Act, 5 U.S.C. 553(e), and the Commission's Rules, 47 C.F.R. §1.401. Each of these Petitions for Rule Making seeks revision of Part 97 of the Commission's Rules, 47 C.F.R. §97.1, *et seq.*, concerning the licensing or operation of stations in the Amateur Radio Service.

2. The petitioners in RM-2664, Mr. Gordon Schlesinger and Mr. William F. Kelsey, request explicit recognition in the Rules of so-called "remotely controlled base stations." They state that considerable confusion exists concerning the definition and operation of remotely controlled base stations, and that there is a need for specific rules to regulate the operation of such stations. Petitioners have proposed specific rules which, if adopted, would both add to the rules several provisions concerning remotely controlled base stations and substantially relax the requirements for the operation of such stations. We have also received several comments from interested parties supporting the basic proposals of RM-2664.

3. The Middle Atlantic FM and Repeater Council (T-MARC), petitioner in RM-2780, seeks simplification of the Amateur Radio Service logging requirements, particularly the rules requiring the notation of all third party traffic sent and received, the retention of station logs for one year, and the recording of transmissions from "open access" automatically controlled repeater stations. T-MARC states that much of the logging required by the Rules is of little benefit to either Amateur operators or the Commission and requests that logging requirements be relaxed accordingly.

4. We believe some of the proposals in the petitions we have received merit serious discussion, and we are herein proposing revisions of Part 97 of the Rules which, if adopted, would result in a substantial simplification of the licensing and operation of stations in the Amateur Radio Service presently licensed as repeater stations, control stations, auxiliary link stations, and all other remotely controlled stations, such as remotely controlled base stations. The revisions we are considering, which are discussed at greater length below, would both accommodate many of petitioners' wishes and would be a significant step in the Commission's program of deregulation of the Amateur Radio Service.

5. Since adopting rules governing the operation and licensing of repeater and associated stations in 1972 in Docket 18803, 37 FCC 2d 225 (1972), the Commission has steadily reduced the burden placed on applicants for and licensees of complex systems of amateur radio stations and has afforded such licensees increasingly greater flexibility in the operation of such stations. For example, in Orders adopted January 10, 1974, and November 17, 1975, we deleted the requirements that certain technical showings be submitted with license applications for repeater and remotely controlled stations. In Reports and Orders in Dockets 20073, 20112, and 20113, adopted May 28, 1975, June 11, 1975, and October 29, 1975, respectively, the Commission revised its Rules to permit the linking, automatic control, and cross-band operation of amateur repeater stations.

6. Our experience since adoption of the rules regulating the licensing and operation of repeater and associated stations in Docket 18803 has demonstrated that amateur radio operators are fully capable of developing and operating complex systems of stations with a minimum of regulation by the Commission. We are aware of no compelling reason why amateurs wishing to operate repeater, auxiliary, control, or remotely controlled stations should continue to be required to obtain Commission permission before beginning such operation, as they have in the past. For this reason, we propose to delete those provisions of Sections 97.40, 97.41, and 97.43 of the Rules requiring that licensees obtain prior approval of the Commission to operate a remotely controlled station and requiring that repeater stations, control stations, and auxiliary link stations be separately licensed. We would discontinue the issuance of station licenses with "combined" station privileges: all amateur station licenses would convey authority to operate as repeater, control, auxiliary link, and remotely controlled stations now operate. Functions now conducted by repeater stations would be conducted under a form of station operation known as "repeater operation." Functions now conducted by control stations and auxiliary link stations would be combined in a single form of station operation known as "auxiliary operation." Auxiliary operation would serve to meet the need for point to point links within a system of stations, including the transmission of control and communication signals to other stations within a system, and the need for the automatic relaying of signals received at one location in a system of stations to stations at other locations within the system. Section 97.3 of the Rules would be revised to include new definitions of repeater and auxiliary operation.

7. Similarly, we believe that operators of other remotely controlled stations, such as remotely controlled base stations, have demonstrated the capability of adequately controlling the emissions of such stations, and that the prohibition against the operation of such stations from control points in portable or mobile operation, presently contained in Section 97.110(b) of the Rules, may be unduly restrictive. Accordingly, we propose to revise the Rules to permit the portable and mobile operation of all primary, secondary, and club stations when such stations are in repeater or auxiliary operation.

8. Because no new station licenses would be issued to repeater stations, as such, we propose to discontinue our policy of assigning call signs prefixed with the letters "WR". Stations presently assigned such call signs would be permitted to retain them indefinitely. A licensee wishing to engage in repeater operation and wishing to obtain a "WR" call sign would be required to request that prefix. Stations with "WR" call signs would be restricted to repeater operation, however.

9. Because stations in repeater or auxiliary operation would be taking advantage of specialized modes of operation, we believe the transmissions of such stations should be distinctively identified. We propose to require that auxiliary or repeater operations conducted by stations with "traditional" call signs (that is, call signs not prefixed with the letters "WR") be identified by the addition of a distinctive suffix to the station call sign. Stations in repeater operation would be identified by the addition of the suffix "R", "RPT", or the word "repeater" to the regular call sign. Stations in auxiliary operation would be identified by the addition of the suffix "A", "AUX", or the word "auxiliary" to the regular call sign. We also propose to revise the station identification requirement for stations in repeater operation or stations in auxiliary operation automatically relaying the signals of other stations in a system to require identification of intervals of at least ten, rather than five, minutes.

10. Petitioner in RM-2780 seeks relaxation of certain logging requirements, and we are considering deletion of the requirement found in Section 97.111(g)(2) of the Rules that communications from open access stations in repeater operation under automatic control be either monitored in real time by the duty or control operator or recorded and the recordings retained for a period of thirty days. This requirement, which was originally intended to ensure that licensees have the capability of determining whether their stations were being used properly during periods when no control operator was on duty, has proven to be of little benefit to the Commission and may unduly burden licensees operating "open" repeater stations under automatic control. Of course, the licensee of a station would continue to be responsible for its proper operation, and we wish to receive comments addressing the issue of the continued usefulness to the Amateur Service of the recording requirement in ensuring the proper operation of "open" automatically controlled repeater stations.

11. We are proposing to revise the present rule that all remotely controlled stations have entered in their logs a list of all authorized control points and copies of all control and auxiliary link station licenses to require the entering of the names, addresses, and primary call signs of all authorized control operators. Such a revision would be based on the proposition that the responsibility for the proper operation of a remotely controlled station should be traceable to specific control operators rather than specific land locations. We also propose to require the posting of a list of authorized control operators at the remotely controlled transmitter site. We are not proposing to delete the requirements that the logs of stations in repeater or auxiliary operation contain certain specialized technical information, however.

12. Additionally, it appears that many Amateur operators seek greater flexibility in the choice of frequencies for repeater and auxiliary operation. Operators of remotely controlled base stations, for example, are not restricted to the repeater frequency subbands listed in Section 97.61 of the Rules, although remotely controlled base stations closely resemble repeater stations, and it may be that such stations should be treated identically. We are therefore proposing to permit both repeater and auxiliary operation on all frequencies allocated to the Amateur Radio Service, except 435 to 438 MHz, and to delete the requirement that frequencies below 225 MHz used for auxiliary operation be monitored by the control operator before and during periods of operation. We would revise Section 97.63 of the Rules, however, to emphasize the two principles which have made possible the efficient operation of many amateur radio stations in relatively small spectrum space, namely, that a station using a frequency has first priority in such use over other stations, and that all frequencies allocated to the Amateur Service are shared on a non-exclusive basis. It is presently the responsibility of amateur licensees to strike an appropriate balance between these principles to ensure the fair and efficient use of available spectrum.

13. The Commission is aware that adoption of the rules proposed herein could result in a significant increase in the number of repeater, remotely controlled station, and associated activities pursued by amateur licensees. We are also aware that severe frequency congestion is presently being experienced in some parts of the country, and that the possibility exists that increased interference might result from adoption of these revisions. Many amateurs have voluntarily established techniques for managing available spectrum, and we commend such efforts. We are not prepared to make specific recommendations in this area at the present time, but we are nonetheless interested in receiving comments concerning present and future anticipated interference patterns, whether present techniques used by amateur operators to limit interference are adequate or could be improved, and whether present levels of voluntary cooperation are sufficient to justify continuation of the existing cooperative system. In this regard, we wish to receive comments concerning the utility of the limitations on the effective radiated power of stations in repeater operation contained in Section 97.67 of the Rules. Should such limitations be eliminated in their entirety, modified, or retained without change? What limitations, if any, should be placed on the effective radiated power of stations in repeater operation operating on frequencies not currently listed in Section 97.67 of the Rules?

14. The specific rule revisions we are proposing are set forth in the attached Appendix. Authority for these proposals is contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended. We invite interested parties to submit comments concerning our proposals on or before April 1, 1977 and reply comments on or before April 15, 1977. An original and five copies of all comments submitted shall be furnished the Commission, pursuant to Section 1.419 of the Rules. Respondents wishing each Commissioner to have a personal copy of the comments may submit an additional six copies. Members of the public wishing to express interest in our proposals may participate informally by submitting one copy of their comments, without regard to form, provided the correct Docket number is specified in the heading of the comments.

15. Individuals wishing to inspect the comments and reply comments filed in this proceeding may do so during regular business hours, 8:00 A.M. to 4:30 P.M., in the Commission's Public Reference Room, 1919 "M" Street, N.W., Washington, D.C. 20554.

FEDERAL COMMUNICATIONS COMMISSION
Vincent J. Mullins
Secretary

APPENDIX

Part 97 of Chapter 1 of Title 47 of the Code of Federal Regulations is proposed to be amended, as follows:

1. In §97.3, paragraphs (i), (m) and (n) are revised, as follows:

§97.3 *Definitions.*

(i) *Additional station.* An amateur radio station, other than a primary station, including the following:

Secondary station. An amateur radio station licensed for a land location other than the primary station location. A station assigned a call sign prefixed with the letters "WR" is also considered to be a secondary station.

Special event station. An amateur radio station licensed for a specific land location for operation designed to bring public notice to the Amateur Radio Service and related to the celebration of an event, past or present, which is unique and of general interest to either the public at large or amateur radio operators.

(m) *Amateur radio operation.* Amateur radio communication conducted by amateur radio operators from amateur radio stations, including the following:

Mobile operation. Radiocommunication

conducted while in motion or during halts at unspecified locations.

Repeater operation. Radiocommunication, other than auxiliary operation, for retransmitting automatically the radio signals of other amateur radio stations.

Auxiliary operation. Radiocommunication for remotely controlling other amateur radio stations, for automatically relaying the radio signals of other amateur radio stations in a system of stations, or for intercommunicating with other amateur radio stations in a system of stations.

(n) *Control*. Techniques used to operate an amateur radio station. Must be one or more of the following:

Automatic control. The use of devices and procedures for control so that a control operator does not have to be present at the control point at all times. (Only rules for automatic control of repeater operation have been adopted. Automatic control of all other types of amateur radio operation must be approved by the Commission in advance on a case by case basis.)

2. In §97.40, paragraphs (d) and (e) are deleted, and paragraph (c) is revised as follows:

§97.40 *Station license required*.

(c) An amateur radio operator may be issued one or more additional station licenses. A secondary station license shall not be issued to an amateur radio operator for a land location where a primary station license has been issued to the same amateur radio operator. This section does not apply to stations assigned call signs prefixed by the letters "WR".

3. In §97.41, paragraph (c) is deleted, paragraphs (d), (e), (f), and (g) are redesignated paragraphs (c), (d), (e), and (f), respectively, and paragraph (b) is revised, as follows:

§97.41 *Application for station license*.

(b) Except for applications for club stations and military recreation stations, each application must state whether the proposed station is a primary or additional station. If the proposed station is an additional station, the application must state the type of additional station.

4. §97.43 is revised, as follows:

§97.43 *Location of station*.

Every amateur radio station must have one land location, the address of which appears on the station license, and at least one control point.

5. In §97.53, paragraph (j) is redesignated paragraph (k), and a new paragraph (j) is added, as follows:

§97.53 *Policies and procedures applicable to assignment of call signs*.

(j) A station only engaging in repeater operation may be assigned a call sign prefixed by the letters "WR".

6. In §97.61, paragraphs (a) and (c) are revised and a new paragraph (d) is added, as follows:

§97.61 *Authorized frequencies and emissions*.

(a) The following frequency bands and associated emissions are available to amateur radio stations for amateur radio operation, other than repeater and auxiliary operation, subject to the limitations listed in paragraph (b) of this section and §97.65:

(c) All frequency bands and the associated emissions authorized by paragraph (a) of this section, except 435 to 438 MHz, are available for repeater operation, including input (receiving) and output (transmitting).

(d) All amateur frequency bands, except 435 to 438 MHz, are available for auxiliary operation.

7. In §97.63, the headnote is revised and the text amended, as follows:

§97.63 *Selection and use of frequencies*.

(a) Although an amateur station occupying a frequency listed in §97.61 has first priority in the use of that frequency over other amateur stations, such frequencies shall not be assigned for the exclusive use of any amateur licensee or licensees and must be shared.

(b) All Amateur Radio Service licensees shall cooperate in the selection and use of authorized frequencies and shall take such other steps as may be necessary to minimize interference to other amateur radio stations. Licensees making prolonged use of a particular frequency or frequencies shall cooperate with other licensees in the use of such frequency or frequencies.

(c) Sideband frequencies resulting from keying or modulating a carrier wave shall be confined within the authorized amateur band.

(d) The frequencies available for use by control operators of amateur stations are dependent on the operator license classification of the control operator and are listed in §97.7.

8. In §97.67, paragraph (c) is revised, as follows:

§97.67 *Maximum authorized power*.

(c) Within the limitations of paragraphs (a) and (b) of this section, the effective radiated power of an amateur radio station in repeater operation shall not exceed that specified for the antenna height above average terrain in the following table:

9. §97.83 is redesignated §97.82 as follows:

§97.82 *Availability of operator license*.

10. §97.85 is redesignated §97.82, as follows:

§97.83 *Availability of station license*.

11. §97.87 is redesignated §97.84, and paragraphs (c), (d), and (e) are revised, as follows:

§97.84 *Station identification*.

(c) Amateur radio stations in repeater operation or stations in auxiliary operation used to relay automatically the signals of other stations in a system, shall be identified by radiotelephony or radiotelegraphy at intervals not to exceed ten minutes.

(d) When an amateur radio station is in repeater or auxiliary operation, the following additional information shall be transmitted:

(1) When identifying by radiotelephony, a station in repeater operation shall transmit the word "repeater" at the end of the station call sign. When identifying by radiotelegraphy, a station in repeater operation shall transmit the fraction bar DN followed by the letters "R" or "RPT" at the end of the station call sign. (The requirements of paragraph (d)(1) of this section do not apply to stations having all call signs prefixed by the letters "WR".)

(2) When identifying by radiotelephony, a station in auxiliary operation shall transmit the word "auxiliary" at the end of the station call sign. When identifying by radiotelegraphy, a station in auxiliary operation shall transmit the fraction bar DN followed by the letters "A" or "AUX" at the end of the station call sign.

(e) A station in auxiliary operation may be identified by the call sign of its associated station.

12. A new §97.85 is added, as follows:

§97.85 *Repeater operation*.

(a) Emissions from a station in repeater operation shall be discontinued within five seconds after cessation of radiocommunications by the user station. Provisions to limit automatically the access to a station in repeater operation may be incorporated but are not mandatory.

(b) Except for automatic control operations, as provided in paragraph (e) of this section, the transmitting and receiving frequencies used by a station in repeater operation shall be continuously monitored by the control operator immediately before and during periods of operation.

(c) A station in repeater operation may concurrently receive and retransmit amateur radio signals on one or more frequency bands authorized for repeater operation. A station in repeater operation, operating in conjunction with one or more stations in auxiliary operation relaying radio signals received at other locations to stations in repeater operation, may use input frequencies not available for repeater operation, provided the input frequencies to the stations in auxiliary operation are in frequency bands authorized for repeater operation.

(d) A station in repeater operation shall be operated in a manner ensuring that the station is not used for one-way communications, except as provided in §97.91.

(e) A station in repeater operation, either locally controlled or remotely controlled, may also be operated by automatic control when devices have been installed and procedures have been implemented to ensure compliance with the rules when the duty control operator is not present at the control point of the station. Upon notification by the Commission of improper operation of a station under automatic control, such operation shall be immediately discontinued until all deficiencies have been corrected.

(f) A station assigned a call sign prefixed by the letters "WR" shall engage only in repeater operation.

13. A new §97.86 is added, as follows:

§97.86 *Auxiliary operation*.

A station in auxiliary operation, either locally controlled or remotely controlled, may also be operated by automatic control when it is operated as a part of a system of stations in repeater operation operated under automatic control.

14. §97.88 is retitled and revised, as follows:

§97.88 *Operation of stations by remote control*.

An amateur radio station may be remotely controlled when there is compliance with the following:

(a) A photocopy of the remotely controlled station license and a list of authorized control operators, their names, addresses, and primary call signs, must be posted in a conspicuous place at the remotely controlled operator, or shall be carried in the possession of any control operator controlling the remotely controlled station from a station in auxiliary operation being operated portable or mobile. The transmitting antenna, transmission line, or mast, as appropriate, associated with the remotely controlled transmitter must bear a durable tag marked with the station call sign, the names of the station licensee and all authorized control operators and such other information as may be necessary to enable the Commission to quickly contact the control operators.

(c) Except for operation under automatic control, a control operator designated by the licensee must be on duty when the station is being remotely controlled. Immediately before and during the periods the remotely controlled station is in operation, the frequencies used for emission by the remotely controlled station must be monitored by the control operator. The control operator shall terminate all transmissions upon any deviation from the rules.

(e) A station in repeater operation shall be operated by radio remote control only when the control link uses frequencies other than the station's receiving frequencies.

15. §97.89 (Amended).

In §97.89, paragraphs (c) and (d) are deleted.

16. In §97.103, paragraph (c)(5) is deleted, and paragraphs (c), (d), and (e) are revised, as follows:

§97.103 *Station log requirements*.

(c) The log of a remotely controlled station shall have entered the names, addresses, and primary call signs of all authorized control operators and a functional block diagram of a technical explanation sufficient describe the operation of the control link. Additionally, the following information shall be entered:

(1) A description of the measures taken for protection against access to the remotely controlled station by unauthorized persons;

(2) A description of the measures taken for protection against unauthorized station operation, either through activation of the control link, or otherwise;

(3) A description of the provisions for shutting down the station in case of control link malfunction; and

(4) A description of the means for monitoring the transmitting frequencies.

(d) When a station has one or more associated stations, that is, stations in repeater or auxiliary operation, a system network diagram shall be entered in the station log.

(e) The log of a station in repeater operation shall have the following information entered for each frequency band in use:

(1) The location of the station transmitting antenna, marked upon a topographic map having a scale of 1:250,000 and contour intervals;

(2) The antenna transmitting height above average terrain;

(3) The effective radiated power in the horizontal plane for the main lobe of the antenna pattern, calculated for maximum transmitter output power;

(4) The transmitter output power;

(5) The loss in the transmission line between the transmitter and the antenna, expressed in decibels;

(6) The relative gain in the horizontal plane of the transmitting antenna; and

(7) The horizontal and vertical radiation patterns of the transmitting antenna, with reference to true north (for horizontal pattern only), expressed as relative field strength (voltage) or in decibels, drawn upon polar coordinate graph paper, and the method used in determining these patterns.

(f) The log of a station in auxiliary operation shall have the following information entered:

(1) A system network diagram for each system with which the station is associated;

(2) The station transmitting band(s);

(3) The transmitter power input; and

(4) If operated by remote control, the information required by paragraph (c) of this section.

(g) Notwithstanding the provisions of §97.105, the log entries required by paragraphs (c), (d), (e), and (f) of this section shall be retained in the station log as long as the information contained in those entries is accurate.

17. §97.109 (Deleted).

§97.109 is deleted.

18. §97.110 (Deleted).

§97.110 is deleted.

19. §97.111 (Deleted).

§97.111 is deleted.

20. §97.126 is revised, as follows:

§97.126 *Retransmitting radio signals*.

No amateur radio station, except a station in repeater or auxiliary operation or a radio remotely controlled station, may automatically retransmit the radio signals of other amateur radio stations. A remotely controlled station, other than a remotely controlled station in repeater or auxiliary operation, shall retransmit only the radio signals of stations in auxiliary operation shown on the station's system network diagram.

21. §97.181 is revised, as follows:

§97.181 *Availability of RACES station license and operator licenses*.

(b) In addition to the operator license availability requirements of §97.82, a photocopy of the control operator's amateur radio operator license shall be posted at a conspicuous place at the control point of the RACES station.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

Editorial amendments of Parts 0, 1, and 97 of the Commission's Rules to change the name of the Amateur and Citizens Division to the Personal Radio Division.

ORDER

Adopted: January 5, 1977;
Released: January 6, 1977

1. This Order is being issued to change the organization statement of the Safety and Special Radio Services Bureau. The Amateur and Citizens Division has recently undergone reorganization, and the name of the Division is herewith changed to the Personal Radio Division.

2. This amendment relates to internal Commission organization, and hence, the

prior notice, procedure, and effective date provisions of the Administrative Procedures Act (5 USC 553) are not applicable. Authority for the promulgation of this amendment is contained in Sections 4(i), 5(b), 5(d), and 303 of the Communications Act of 1934, as amended and Section 0.231(d) of the Commission's Rules.

3. Accordingly, IT IS ORDERED, effective January 20, 1977, that Parts 0, 1, and 97 of the Rules and Regulations are amended as set forth in the Appendix attached hereto.

FEDERAL COMMUNICATIONS COMMISION
Richard D. Lichtwardt
Executive Director

NOTE: Rules changes herein will be covered by T.S.I(74)-7.

APPENDIX

Parts 0, 1, and 97 of Chapter 1 of Title 47 of the Code of Federal Regulations are amended, as follows:

In Sections 0.132(a), 1.951(a), 97.25(d), and 97.41(d), the words "Amateur and Citizens Division" are deleted, and the words "Personal Radio Division" are substituted in each instance therefore.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the matter of

Revision of Parts 0, 1, and 97 of the Commission's Rules to institute a system of Interim Amateur Permits in the Amateur Radio Service

ORDER
Adopted: January 5, 1977
Released: January 13, 1977

By the Commission: Commissioner Lee absent.

1. Under the existing Amateur Radio Service licensing system, Amateur Radio Service licensees successfully completing examinations for higher class licenses than the licenses they hold must wait while their new license applications are processed at the Commission's Gettysburg, Pennsylvania, facility before they may take advantage of the added privileges afforded them by their new operator licenses. A delay of several weeks may be involved, although both the licensee and the Commission are aware of the results of the examination and know a new license will be issued.

2. By this Order, we are revising Parts 0, 1, and 97 of the Commission's Rules to permit the issuance of Interim Amateur Permits by the Engineers in Charge of the various Commission field offices. Interim Amateur Permits (FCC Form 660-B) will be issued to applicants already holding amateur operator licenses as soon as possible after successful completion of higher class license examinations and will authorize immediate utilization of all additional operating privileges acquired. Licensees operating under the authority of Interim Amateur Permits will be required to add distinctive suffixes to their station call signs denoting the Commission district office at which their higher class licenses were obtained. Interim Amateur Permits will be valid for a period of 90 days or until issuance of the permanent station and operator licenses, whichever is less. A record of the issuance of an Interim Amateur Permit will be retained at the office of issuance, and requests for confirmation of an operator's status must be directed to that office.

3. Authority for these amendments appears in Sections 4(i), 5(d), 303, 307, 308, and 309 of the Communications Act of 1934, as amended. Some of the amendments adopted herein are editorial and procedural in nature, and the prior notice and public procedure provisions of the Administrative Procedure Act, 5 U.S.C. 553, are not applicable. Further, because of the enormous number of Amateur and Citizens Radio Service license applications we receive each month, rapid implementation of the interim permit system is essential, and we are, for good cause, dispensing with the prior notice and public procedure provisions of the Administrative Procedure Act as impracticable.

4. Accordingly, in view of the foregoing, the public interest being served thereby, IT IS ORDERED that Parts 0, 1, and 97 of the Commission's Rules ARE AMENDED as set forth in the attached Appendix effective March 1, 1977.

FEDERAL COMMUNICATIONS COMMISSION
Vincent J. Mullins
Secretary

NOTE: Rules changes herein will be covered by T.S.I(74)-7.

APPENDIX

Parts 0, 1, and 97 of Chapter 1 of Title 47 of the Code of Federal Regulations are amended, as follows:

1. In §0.314, a new paragraph, (v), is added, as follows:

§0.314 *Additional authority delegated.*

(v) To issue Interim Amateur Permits to Amateur Radio Service licensees, pursuant to Part 97 of this Chapter.

2. In §1.922, a new FCC Form and Title are added, as follows:

§1.922 *Forms to be used.*

FCC Form	*Title*
660-B	Interim Amateur Permit

3. In §1.925, the headnote is amended, and a new paragraph, (e), is added, as follows:

§1.925 *Application for special temporary authorization, temporary permit, or interim amateur permit.*

(e) Upon successful completion of a Commission supervised Amateur Radio Service operator examination, an applicant already licensed in the Amateur Radio Service may operate his amateur radio station pending issuance of his permanent amateur station and operator licenses by the Commission for a period of 90 days or until issuance of the permanent operator and station licenses, whichever comes first, under the authority of a properly executed Interim Amateur Permit (FCC Form 660-B). An Interim Amateur Permit conveys all operating privileges of the licensee's new license, but may be set aside by the Commission within the 90 day term if it appears that the permanent operator and station licenses cannot be granted routinely.

4. §1.934 is revised, as follows:

§1.934 *Procedure with respect to amateur radio operator license.*

After an application for an amateur radio operator license is accepted and an examination conducted by the Commission in accordance with Part 97 of this Chapter, the examination is graded by the office supervising the examination. If the applicant is successful, and if the applicant already holds a license in the Amateur Radio Service, the supervising office issues the applicant an Interim Amateur Permit conveying all operating privileges of the applicant's new operator license. The results of the examination are forwarded to the Commission's Gettysburg, Pennsylvania facility for issuance of a license.

5. In §1.1115, paragraph (c)(6) is revised, as follows:

§1.1115 *Schedule of fees for the Safety and Special Radio Services.*

(c)

(6) Applications for Interim Amateur Permits or Novice Class licenses in the Amateur Radio Service, applications for amateur stations under military auspices, and applications in the Radio Amateur Civil Emergency Service (RACES).

6. In Section 97.3(d), the definition for "operator license" is amended and a new definition, "Interim Amateur Permit," is added, as follows:

§97.3 *Definitions.*

(d)

Operator license. The instrument of authorization including the class of operator privileges.

Interim Amateur Permit. A temporary operator and station authorization issued to licensees successfully completing Commission supervised examinations for higher class operator licenses.

Station license. The instrument of authorization for a radio station in the Amateur Radio Service.

7. A new §97.32 is added, as follows:

§97.32 *Interim Amateur Permits.*

(a) Upon successful completion of a Commission supervised Amateur Radio Service operator examination, an applicant already licensed in the Amateur Radio Service may operate his amateur radio station pending issuance of his permanent amateur operator and station licenses under the terms and conditions of an Interim Amateur Permit, evidenced by a properly executed FCC Form 660-B.

(b) An Interim Amateur Permit conveys all operating privileges of the applicant's new operator license classification.

(c) The transmissions of amateur radio stations operated under the authority of Interim Amateur Permits shall be identified in the manner specified in §97.87.

(d) The original Interim Amateur Permit of an amateur radio operator shall be kept in the personal possession of or posted in a conspicuous place in the room occupied by such operator when operating an amateur radio station under the authority of an Interim Amateur Permit.

(e) Interim Amateur Permits are valid for a period of 90 days from the date of issuance or until issuance of the permanent station and operator licenses, whichever comes first, but may be set aside by the Commission within the 90 day term if it appears that the permanent operator and station licenses cannot be granted routinely.

(f) Interim Amateur Permits shall not be renewed.

8. In Section 97.87, paragraph (f) as amended, is redesignated paragraph (g) and a new paragraph (f) is added, as follows:

§97.87 *Station identification.*

(f) When operating under the authority of an Interim Amateur Permit with privileges authorized by the Permit, but which exceed the privileges of the licensee's permanent operator license, the station must be identified in the following manner:

(1) On radiotelephony, by the transmission of the station call sign, followed by the word "interim," followed by the special identifier shown on the interim permit;

(2) On radiotelegraphy, by the transmission of the station call sign, followed by the fraction bar DN, followed by the special identifier shown on the interim permit.

(g) The identification required by this section shall be given on each frequency being utilized for transmission and shall be transmitted either by telegraphy using the international Morse code, or by telephony, using the English language. If the identification required by this section is made by an automatic device used only for identification by telegraphy, the code speed shall not exceed 20 words per minute. The Commission encourages the use of a nationally or internationally recognized standard phonetic alphabet as an aid for correct telephone identification.

Tracking the Hamburglar

LOOTED: Regency HR-2A with extra osc. deck for xmit section, s/n 04-06931. Has following crystals (xmit) 146.37, 52, 34, 07, 19, 16, 94 (rcvr) 146.97, 52, 76, 67, 79, 94 marked with Dymo tape on front. Has special telephone female jack hanging from back for touchtones. Also Regency AR-2 two meter amplifier, s/n 115-0388. These were stolen between December 18 and 22, 1976 from under dash of two-tone green pickup truck in my driveway at 11318 Gravenhurst Drive, Cincinnati, Ohio. A 50 dollar reward is offered leading to convictions of suspects involved. Notify Herbert L. Drake W8QIL, 11318 Gravenhurst Drive, Cincinnati, Ohio 45231, or your local police department. Items have been entered into (NCIC) FBI computer, by Police Dept., Colerain Twp (Hamilton County) Ohio OH0314200.

LOOTED: Icom 22S, s/n 2265. Channeled for: 94/94, 22/82, 28/88, 52/52, 16/76, and 90/30. Home brew 1800 cycles osc. built into AM radio was stolen with rig. Stolen from: Ed Weiss W9SSJ, 4501 West Kentucky #56, Denver CO 80219.

ABDUCTED: Regency HR-2MS, s/n 11-01554. Channeled for: 34/94, 22/82, 16/76, 143.99/148.01, 94/94 and 82/82. Stolen in Topeka, Kansas from: C. E. Widsteen 303-687-3142, Box 937, Woodland Park CO 80863.

RUSTLED: Motorola Metrum II, #C064 with 94, 76, 88, 82, 67, 75, 85, 34, 70, 52, 91, 79. 1B PL. Motorola HT220 H23FFN #TP1174C with separate 12 freq t&r sw, 1BPL, TT on back, "custom WB9BVT" on rear. Robert Scott WB9BVT, 200 W. Chicago Ave., Oak Park IL 60302.

VANDALIZED: Swan 350, s/n 0-84887 from my van. Bill Zimmerman K8BEB, 18071 Floral, Livonia, Michigan 48152.

Corrections

My article "IC Audio Frequency Meter," Holiday issue, has an error on the schematic. Pin 4 of the 555 should connect to pin 8 instead of pin 2. Thanks to Hubert Minchow for finding this error.

Gene Hinkle WA5KPG
Austin TX

Walt Pinner WB4MYL
7304 Lorenzo Lane
Louisville KY 40228

The Capacitor Comparator

- - super simple test equipment

If your junk box is like mine, tucked way back in the corner is a spot where you throw all those unmarked, unidentified capacitors that you just KNOW will come in handy some day. Round ones, square ones, flat ones, fat ones, piston and bypass ones, and those a guy could have a great time screw-drivering if he just knew where to use 'em.

The simple circuit here is an easy one-evening project that when completed will provide an audio tone comparison of a built-in reference capacitor to an unknown capacitor connected to the test clips. Bearing in mind that the larger the capacitor the lower the tone, it is a simple matter to establish the value of unmarked units. The circuit, as described, will identify caps between .5 pF and .001 uF by providing tones between 8 kHz and 100 Hz. The heart of the tester is a 555 timing IC and may be operated from any dc voltage source between 8 and 14 volts.

An LED indicator is provided for testing values larger than .001 uF which do not produce a tone but merely turn the LED off and on. A .1 uF unit will trigger the indicator at approximately 5 Hz.

Piston, compression, and rotary trimmers may be identified by first making a comparison fully closed and then fully opened. Small gimmick caps made from twisted leads are also easily sized.

The LED is, of course, optional, as well as the number of reference capacitors. Any NPN switching or audio transistor may be used in place of the MPS6512. If the LED is not needed, the transistor may be eliminated and the speaker with its 1 uF coupling capacitor is connected directly to pin 3 of the IC. Why not try a Poly Paks unmarked assortment – 100 caps $1.98?? Happy sorting. ■

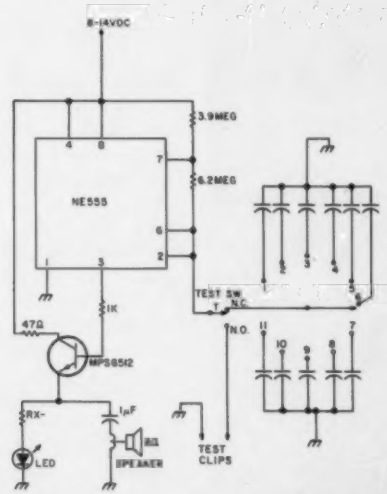
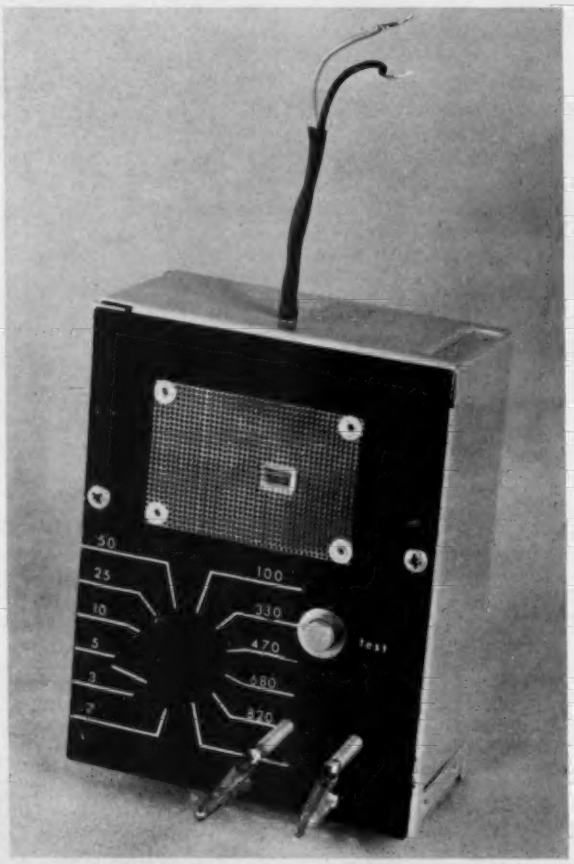


Fig. 1. LED indicator and RX – see LED specs. Capacitor bank: 1 = .7 pF; 2 = 3 pF; 3 = 5 pF; 4 = 10 pF; 5 = 25 pF; 6 = 50 pF; 7 = 100 pF; 8 = 330 pF; 9 = 470 pF; 10 = 680 pF; 11 = 820 pF. Test switch – SPDT push-button.



The LED indicator is located behind the jewel on the speaker grill. The test clips are mounted on small bronze springs for easy attachment to various caps.

Logical Storage for Logic

-- not recommended for CMOS

D. E. Stanfield
3408 Catalina Dr.
Atlanta GA 30341

To be honest, I really don't care if you paid less for your chips than I did for mine. Nor am I interested in the psychological motivations that caused you to buy them. What really counts is that we both know that integrated circuits in a jumbled pile do not facilitate rapid retrieval of specific chips.

By way of illustration, assume that today's mail brought several plastic bags of assorted chips. Their price in the magazine had been so low that you rushed off a check and now you have them in your hands. If you are like most of us, you will take your bags and find a place to examine their contents.

Those who have hunted for buried treasure or used metal detectors know the special emotions you will feel as you sort through your chips. A 7400. Nice but ordinary. A 7425. What is it? A 74196. Maybe it's not gold but it sells for more than this whole bag cost. And so on. You recognize many numbers and remember several projects involving their use.

Eventually, you've seen them all and, hopefully, are pretty pleased with your assortment. At this point, what do you do? You can do what I used to do and dump them into boxes for storage. You can throw them out or immediately build a super, self-clocking digital do-it-all.

If you choose the first option, let me point some things out. First, you probably won't remember every type of chip in those boxes for more than two minutes. Second, even if you do remember a specific chip being in a certain box, odds are that it won't be among the first twenty-seven you check. Finally, the pins on integrated circuits do not possess amazing mechanical strength. Once in a pile, these pins have the irritating habit of so interlocking themselves with the pins of neighboring

My first method of storing integrated circuits left me with the vague feeling that perhaps I hadn't arrived at a perfect solution to my problem.

chips that severe bending leading to breakage can result from trying to separate them.

One solution to all of these problems would be to mount integrated circuit sockets on perf or circuit board and plug in all your chips. However, a couple of moments spent checking the prices of such sockets will probably convince you that there must be a better way. If they don't, please send me all the money you can spare as I need it more than you.

When I faced this problem, I sought a solution that would allow me to plug in my chips, but I didn't want to spend a lot of time or money. I evolved two simple solutions that quite adequately met these requirements. My first method was to punch small holes in a piece of cardboard and insert the chips into those holes. The primary advantages of this technique are extremely low cost, readily available materials, and the fact that the stacking of several boards results in a compact, high-density storage system. The principal disadvantage is that it does take a little time to punch the holes.

My other answer to these problems was to stick the chips into a sheet of styrofoam and go enjoy some liquid refreshment. This method takes less time but I had a lot trouble finding the styrofoam I wanted and the sheets run about a dollar each.

Either method works very well and, for various reasons, I use them both. However, I tend to use the cardboard for chips I don't need right away and the styrofoam for those I've targeted toward specific projects. Using both methods is a logical choice for me, but you can certainly use either one by itself.

There are two other points that may assist you in selecting which method to use: It is possible to use both sides of the styrofoam (which cuts costs in half), and the punched holes in the cardboard act like sockets (which allows you to reinsert other chips into a vacated position). This is handy if you are trying to arrange the chips by type.

If you decide to use cardboard, your first step should be to gather your materials together. These include corrugated cardboard, graph paper ruled ten spaces to the inch, a suitable punch, a knife, a ruler, some masking tape, and a pen or pencil. The cardboard should be larger than the overall dimensions you desire so that it can be trimmed to size. I cut mine eight by ten inches but you can adjust these figures to fit your requirements.

I found the graph paper ruled off at ten spaces to the inch at an office supply firm. While I had to buy an entire pad, this particular size of graph paper lends itself perfectly to laying out boards using integrated circuits.

The punch can be anything from a small nail fitted with a handle to a sharpened test probe. I used a little gadget called a Seam Ripper, used in sewing to open buttonholes and pick threads.

Once you've gathered these materials, you can begin fabrication of the board by using the knife to trim the cardboard to the size you want. I used eight by ten inches, but another size may suit your purposes better. A metal ruler or yardstick makes cutting a straight line very easy. If you anticipate needing more than one board, now is the ideal time to cut them.

After the cardboard is cut, you may lay it aside and prepare a sheet of graph paper which will be used as a guide when punching the holes. My paper measured eight and one-half by eleven inches, so my first step was to draw off a block the size of my boards (eight by ten inches). If your board will be larger than your graph paper, you can glue or tape several pieces together to form a larger sheet. Again, draw off a

Use a metal ruler or yardstick and a knife to cut a piece of cardboard to the desired size.

A sheet of graph paper ruled off with ten spaces to the inch is prepared as a guide to be used when punching holes in the cardboard.

After the graph paper is properly ruled, it is cut to the same size as the cardboard and attached to it with masking tape. Then, each of the seven intersections on the segments of the horizontal lines measuring six spaces in length are punched. The tool shown in use is called a Seam Ripper, normally used in sewing.

block on your paper corresponding to the size of your board.

The next objective is to draw off a grid marking where the chips will be placed. The most common chips have fourteen pins arranged seven on a side. The pins are spaced 1/10 of an inch apart and the spacing between the two sides is 3/10 of an inch. As the chips protrude a bit beyond the pins, each chip will require a minimum space measuring 3/10 by 7/10 of an inch.

Some of the more complex integrated circuits having more than fourteen pins use a spacing of one-half inch between rows of pins. If you are using these types, you will need to make allowance for this fact and develop your own layout.

Whether you wish to devise your own spacing arrangement for ordinary fourteen pin chips or the larger variety, let me suggest that you leave a good bit of room around each chip. This will make inserting and removing chips much easier since your fingers will have enough space to get a good grip on the chip.

If you wish to duplicate my spacing, begin by ruling off a rectangle measuring eight by ten inches. Then, arrange your graph paper so that one of the eight inch sides is at the top. Place a mark in the upper left-hand corner at a point six spaces from the top and seven spaces from the left of the eight by ten inch rectangle. Similarly, in the upper right-hand corner, place a mark six spaces from the top and seven spaces from the right side of the rectangle.

In the lower left and right corners, place marks at points seven spaces from the bottom and seven spaces from the sides. Join the four marks to form a smaller rectangle within the eight by ten inch borders.

Then, starting at the top of this new rectangle, count down three spaces and draw a horizontal line from edge to edge of the smaller rectange. Next, count down four spaces from the previous line and draw another horizontal line. Continue by alternating the spacing between horizontal lines three and four spaces until you reach the bottom line of the small rectangle.

When you finish the horizontal lines, begin in the upper left corner and count six spaces to the right. Draw a vertical line from top to bottom of the inside rectangle. Then count four spaces to the right of the previous line and draw another vertical line. Continue by alternating six and four spaces until you reach the right side of the inside rectangle.

At this point, cut the graph paper along the lines of the eight by ten inch rectangle. Use masking tape and fasten this eight by ten inch graph paper to the top of the eight by ten inch cardboard previously prepared. Be sure to align the edges of the graph paper and cardboard correctly.

After all the holes have been punched, the graph paper is removed from the cardboard and the chips are inserted.

With the graph paper side up, lay this cardboard on a piece of wood and begin punching. Punch a hole at each intersection along the horizontal lines that are six spaces in length. Punching both ends and all points between them will give you seven holes in a row. This corresponds with one side of a chip.

As you are punching, penetrate the graph paper and the cardboard until you feel your punch against the wood. It is not necessary to go through the bottom layer of the cardboard, just be sure that you touch it.

After you have punched all the six space segments on each horizontal line, you should remove the graph paper from the cardboard. This graph paper can be used as a punching guide for many other pieces of cardboard, so don't throw it away.

All that is left is to insert your chips. Remember to check for bent pins and to push each chip into place firmly.

For those of you who feel that the previous method would take up more of your time than you can spare, let me strongly recommend that you give the following system of chip storage a try. The reason styrofoam lends itself so well to holding chips is that you can easily push the pins into the styrofoam without having to drill or punch holes to hold them.

While there are two ways (neat and not so neat) to use the styrofoam, both require at least one sheet of styrofoam. I thought that this would be easy to find, but some quick looking around proved me wrong. Not only did I look in all the wrong places, I finally ran out of wrong places to look. My search eventually led me to one of those craft shops where they sell string and weeds.

After I had finally located my styrofoam, someone mentioned that friendly florists are a great source. I haven't checked this out yet. I feel that it is my duty to warn you that as you search you can expect a lot of busy clerks to direct your path to their supply of styrofoam ice chests.

Once you have your styrofoam, you must decide how neat you want your finished stock of chips to look. If you really don't care, simply start pushing one chip at a time into any area of the styrofoam that looks inviting. When you run out of room or chips, you can stop.

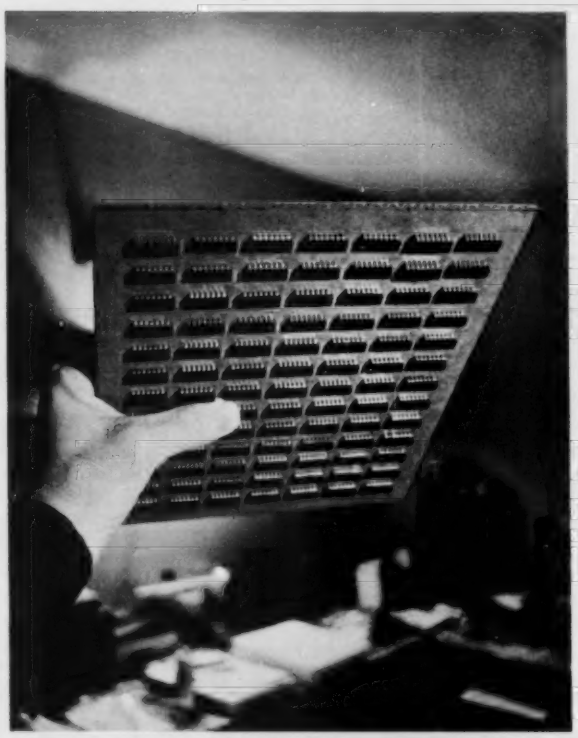
If you would prefer to have the results of your efforts look more professional, allow me to suggest a simple way to do so. In essence, you will make a ruler with appropriate marks to show the proper location of each chip. This ruler should be about 3/8 of an inch thick so that when placed on edge, this thickness will serve as an easy to use guide for setting the spacing between rows of chips.

To make this ruler, choose a length of wood (such as molding) roughly 1/2 by 3/8 inches high and wide. One of these dimensions should equal the spacing you want between rows of chips. The length of this wood should be an inch or two greater than the width of your styrofoam sheet.

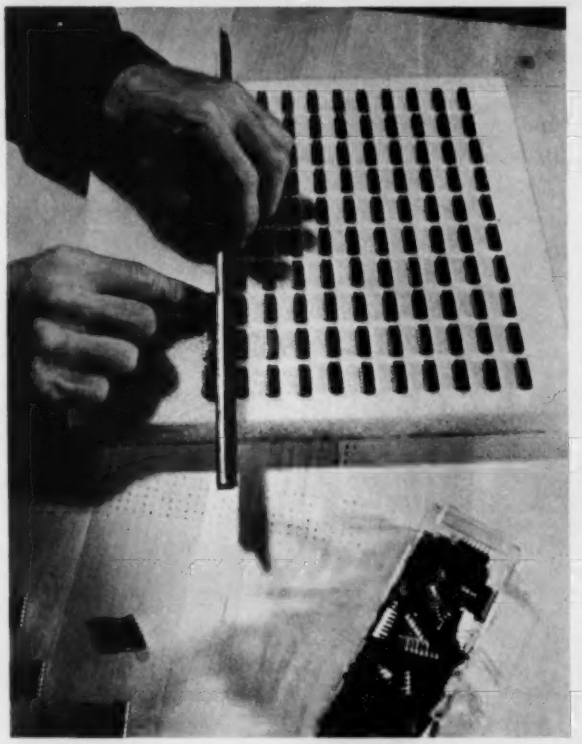
Next, lay this piece of wood across the width of your styrofoam so that the side whose thickness you want as the distance between horizontal rows of chips is on the bottom. In other words, imagine that there are already two rows of chips correctly spaced on the board and place the wooden strip so that it would exactly fit into the space between the rows.

Using a pen, draw a mark on the wood at each edge of the styrofoam. Try to equalize the lengths of the wood extending beyond each edge of the styrofoam before making the marks.

Now you will have to determine the spacing



This fully populated board is being held upside down to show that the cardboard will hold the chips quite securely.



This photo demonstrates how the homemade ruler serves as a spacing guide to set the distance between horizontal rows of chips.

Marks on the homemade ruler show where to place each chip. Marks near each end of the ruler serve to align the ruler with the edges of the styrofoam.

between the individual chips on the horizontal rows. An easy way to figure out the spacing is to set out a row of chips on a sheet of graph paper and working with the width of your board setting the outside limits of the row, line up the chips at different spacings until you have them like you want.

Once you are satisfied with the spacing, bring your ruler next to this row of chips and mark the locations of the edges of each chip on the ruler. Do not forget that the two marks you previously placed on the strip of wood located the edges of the styrofoam. Therefore these two marks should be lined up so that they are spaced equal distances beyond their respective chips.

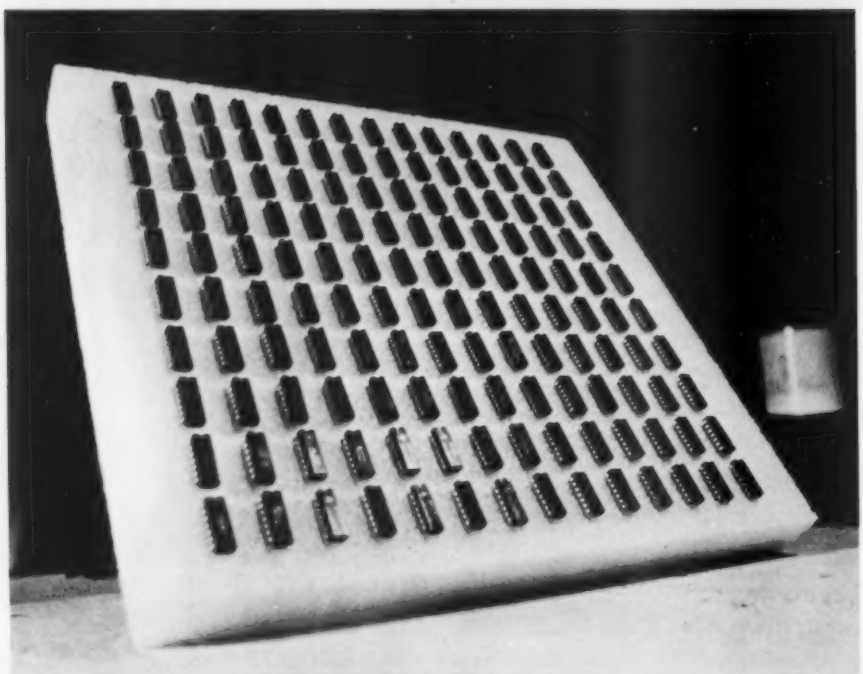
To use this ruler, set it across the styrofoam so that the marks for the edges line up with the edges of the styrofoam. Place it near the top edge of the styrofoam so that all chip and edge locating marks are visible to you and the correct side is on the bottom. Adjust its location until the edge nearest you corresponds to the place where you want the top edge of your first row of chips. Then, while holding the ruler firmly in place with one hand, use the other to plug in the chips.

An easy way to do this is to line up the ends of the chip with the chip location marks and then align the pins so they are flush with the edge of the ruler. Once these conditions are met, push the chip straight into the styrofoam. When seated correctly, the pins on the side of the ruler will be touching it.

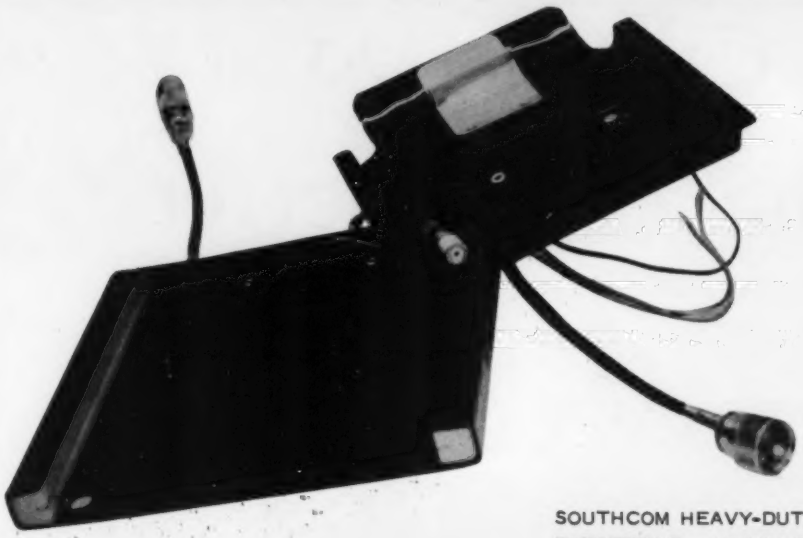
Once you complete the first row, shift the ruler down and reposition it so that its top edge is touching the bottom edge of first row of chips. Again, line up the edge locating marks with the edges of the styrofoam and insert chips at the marked locations.

Follow this procedure with all succeeding rows and you will finish with a neat set of stored chips. While things may sound a bit involved, you will find that once you get started, things proceed quite rapidly.

For those of you who like systems thinking, it is not difficult to keep a record of the location of every chip. Assign each board a number, each horizontal row a letter, and each position on the horizontal rows another number. Then an entry such as 07-F-05/7410 would tell you fifth chip on the sixth row of the seventh board was a 7410. ■



Once all the chips have been inserted, you will have a neat and very practical storage system.



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CB Can Do Some Things Better

-- are you missing some fun?

David F. Norman
622 W. Sunset Blvd.
Fort Walton Beach FL 32548

Much has been written about "stepping up" to amateur radio from CB. As amateur ranks begin to swell with newcomers from Citizens Band, we can expect to see many more articles on the subject. However, transition between services should not be – and isn't – a one way process. A great many amateurs have realized that CB does things that no phase of amateur radio – including 2 meters – can do. Let's take a look at some of the reasons why the "compleat ham shack" should include a CB transceiver.

Travel Aid

Use of CB by amateurs is seldom limited to the shack. Nowadays, you can see quite a few mobile operators with both 2 and 11 meter antennas and rigs installed in the family car. And why not?

Amateurs on the highway have the same problems to cope with as other motorists. Perhaps in your area you can always hit the nearest repeater; you would find many other locations in sparsely populated areas where you could not reasonably expect to reach anyone, anywhere, with a 2 meter mobile. Even if you are equipped with high frequency gear, your contacts are more likely to be entertaining than helpful as far as your circumstances on the highway are concerned.

Let's assume that you *are* well within range of a local repeater. What is the chance of receiving timely information regarding road conditions and traffic jams on 2 meters? Pretty slim, right?

Okay. At present there is no better system than CB for finding out what is happening a few miles ahead. There is no more reliable way – on the average – of requesting help when faced with car trouble or the discovery of a serious accident. Despite the short range and interference of CB, it has proven its worth time and time again to the traveling public.

Perhaps you don't care for his operating procedure, but if you have a bad back and your wife is faced with changing a tire on the camper in one hundred degree

More and more amateurs are finding CB a useful addition to their mobiles and shacks – with good reason.

weather, are you going to refuse help from the "Trottin' Turkey?" Not unless you are a damn fool.

If the XYL has never been quite able to grasp the necessary theory and code – or didn't care to – you may have wished that there were some legal way for you to keep in touch when she is out in the car. This is the beauty of CB. All that is necessary to operate a CB unit is a simple application. Under one license, your entire family is covered. But you knew that already.

One of the large CB manufacturers used to run ads to the effect that no woman should drive alone without one. An awful lot of CBers agree.

Of course, no amateur would be guilty of speeding, so under most conditions "Smokey reports" would not be of value to him. However, no one likes to be surprised when he is a long way from home.

One thing more about traveling with a CB: You don't have to worry about CBers holding against you the fact that you hold an amateur ticket. Most of them are pretty tolerant.

Fig. 1. Tom Goldsmith WB4EQU is only one of the active amateurs who have added CB. Tom's highly modified 2 meter rig with its T/T pad still has the place of honor on the hump, but the CB comes in handy, too.

Introduction to Radio

It is not at all uncommon for someone to be exposed to amateur radio and then vow to get his own ticket. Unfortunately, a great many aspiring amateurs get discouraged by how much code and theory they have to learn before they can do any phone work. Perhaps even your XYL would get on the ball, if she only knew how much fun radioing really is.

A little taste of honey often makes someone want more. With the encouragement that you can give and the fun and experience that CB can offer, your XYL (or YM or YL) has a good chance of making the grade. Even if you have been licensed for several years, there is a good chance that your XYL has never talked to *you* over a radio. With CB, you can put her on the air in a couple of hours.

Overcoming Mike Fright

You might not believe it, but every CBer that you hear on the air had a first time – just like you. The same trembling, proud, sweaty feeling that grabbed at you grabbed him. At one time the 10-signals that he now uses so glibly and the CB slang that assaults your ears were as awkward to him as Q-signals and amateur pleasantries were to you. I know that this statement will probably prompt a lot of argument, but the fact is that most

Fig. 2. One of the major pluses in CB's favor is the "family style" license. This means that wives – such as the author's XYL – may have the advantages of two-way communication, even if they are not electronically inclined.

QRL	10-6
QRG	10-93
QRT	10-3
QSL*	10-4
QSM	10-9
QRV	10-8
QSP	10-5
QSY	10-27
QTR	10-36
QTH	10-20
QRS	10-11
QRRR	10-33

*Roger is usually phone acknowledgement.

Fig. 3. Partial comparison of CB "10-signals" and amateur "Q-signals." Not all of these translate exactly.

CBers are people just like amateurs: They simply like to talk on the radio.

Whether you agree with that or not, you will have to admit that the enthusiasm of CBers is contagious. If you nourish that enthusiasm, and spring for a CB unit — perhaps trade that old receiver for one — for the family car, there is a good chance that within a few weeks there will be more than one amateur in your family.

The CB in the Shack

If you decide to install a CB in the car, you will probably want to install a matching unit at home. Not only would you then be able to call home when you are on the way home from work, but you would also have the peace of mind that comes from knowing that your wife or daughter can call you for help — without having to leave the car.

Even if you are reluctant to install the CB in your domain, the shack, you can find a corner in the kitchen or family room where it can repose in all of its humble glory. Ask the XYL. She is bound to have an opinion.

Public Service

So far we have talked about all of the wonderful things that CB do for you. However, this is another of those two-way streets. Along with the rights and privileges which come with that CB license come certain responsibilities — moral, if not legal.

It goes without saying — almost — that you will operate the CB unit in as legal a manner as you operate that ham rig, but there is more to it than that. When you receive a road report, you obligate yourself to the sender of it. Since you will likely not have a chance to return that favor to him personally, this obligation makes you bound to do the same for others somewhere down the road.

Your obligation to CBers probably already exists, *even if you don't have a CB unit.*

Remember that last disaster that struck your area? It might have been a hurricane, a brush fire, an earthquake, or a tornado. Whatever it was, you can bet your favorite QSL card that there were CBers right in there donating their time and equipment, and even risking their lives, to do their part.

During Hurricane Eloise, I was busy on the CB base in the Civil Defense Center, talking to and encouraging brave, scared CBers who stayed out until the last minute to warn sleeping residents in low-lying areas that the hurricane was going to strike Fort Walton Beach and not pass west as the weather wizards had predicted. Most of these men had families that they would have much rather been with. Few of them were even regular members of the CD. The major qualification that most of them had was the CB unit in the car or truck.

I don't mean to imply that hams weren't there; the job that they did on 2 meters was great. And then the lights went out all over town.

Emergency repeater power is fine. However, when the water is up to your headlights and the wind is blowing at 125 mph, it is damn hard to get to most repeater sites.

Another instance comes to mind.

During the same storm, emergency shelters were opened in the schools. Anticipating power and phone failure, we sent a mobile unit to each school to provide communications back to CD control (we stopped using callsigns early in the storm and used only unit numbers; there was simply too much traffic to handle). After the storm had abated, but before the people were released from the shelters, one of the shelter CB operators wanted to secure. We (I) told him to hang tight for another hour. It is a good thing that I did.

Within a few minutes, he called in asking for an ambulance. A young girl was hemorrhaging badly. All at once, another station broke in. The breaker was another of the CBers. This one was parked beside the ambulance at one of the hospitals — his own idea — and as he reported that the ambulance was on the way, I could hear the siren wailing.

Would anyone like to try to compute the odds of having two units equipped with 2 meter rigs in both of those places at that particular time?

Any amateur who claims to be interested in community service should definitely equip himself with CB. In several emergencies, stretching over the last decade, I have personally seen CB used as both the common denominator providing interface between various radio services and as the main bulwark of communications

Fig. 4. Terry Bishop, owner of this wrecker, is typical of community-minded CBers who volunteer their time and equipment during emergencies and disasters.

when everything else quit.

Then, too, there is simply the matter of numbers. If your small child turned up missing, you could get every amateur in the area to look. If you happen to live in a fair-sized city, the only problem with asking for help on the CB channels would be that you might have more help than you'd know what to do with. Every single car would be CB-equipped and able to maintain contact with all of the other units.

Get With It

If all of the above isn't enough reason for you to trot out and get one of the 23-channel units or a more sophisticated 40-channel model, look at it this way.

Any CBer could tell you that the skip conditions on 10/11 meters are pretty bad – pretty good, depending on how you look at it. If you are wondering whether 10 is hot or not, all that you have to do is turn on the CB and listen for the "Golden Boy" to come booming out of Nova Scotia. Then turn off the CB and fire up the 10 meter rig for a good crack at a little DX.

Or you can always tell yourself that the CB unit hidden in the bottom of your shopping bag and smuggled into the house will be converted to 10 – just as soon as you check it out with a "good buddy" or two. The same goes for that Moonraker beam. All that you have to do is shorten the elements a bit. Of course, you had first better put it together like the manufacturer says.

Whatever words you might have to eat, or rationalization you feel compelled to make, don't let misguided pride stand between you and one of the handiest pieces of gear that you have ever seen. Just think what your knowledge of radio and antennas can accomplish with something that works well for the rankest tyro. ■

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LETTERS

from page 17

Band radio service." The following frequencies were offered: 27.54 to 28 MHz and 222 to 224 MHz.

You should be aware that the amateur service use of the 220-225 band is increasing explosively, plus the proposed "Communicator" license with its reduced licensing requirements for citizens will necessitate full use of this band by the amateur service.

We at this time question your committee's judgment in the matter. From the Table of Frequency Allocations, FCC Vol. 2 Rules and Regulations, we look at the following frequencies being held or possibly "hoarded" for total government use: 225-235 MHz, 235-267 MHz, 335.4-399.9 MHz, and 406-420. These are all fixed and mobile frequencies and exclude Space Telemetry and Aeronautical Radionavigation.

Please submit to us the following information:

Names of each agency with its representative and his position with the agency, methods used to determine spectrum availability, and were the following tools used: 1. % of occupancy level based on monitoring to determine actual usage; 2. Accurate user records and forecasting; 3. Careful evaluation of the priorities of the needs of the United States citizens.

Please notify me within 10 days if it will be necessary to invoke the Freedom of Information Act to expedite this request for information.

Merrill See W8BGZ
Kalamazoo MI

The results next month. — Ed.

KENTUCKY — EAT CROW!

"Big Brother" is here and now in the shape of Uncle Charley, and only Uncle Charley has the constitutional authority to regulate the transmission of energy on the airwaves (in the USA).

And not even the FCC yet has the power to tell us what we can *hear*. We are not yet to the degree of regulation held by the Russian government over their citizens.

I believe that if any of those poor Kentuckians who have lost equipment and money in fines were to fight back, they could make the State of Kentucky eat crow. It is highly unlikely that the anti-scanner law is constitutional, and it most likely violates the Federal Statutes that set up the FCC in the first place.

If you will recall, some states attempted to outlaw radar detectors (receivers) but were unable to enforce the laws, and you never hear of anyone having any problems on that score any more.

I would think you could suggest in one of your columns that those poor Kentuckians should get in touch with the American Civil Liberties League, their lawyers, their congressmen, etc., and have the stupid law repealed.

O. D. Whitwell WB5YBO
Austin TX

DOWNHILL

I am a computer repairman for the U.S. Army Hawk missile system. I read your magazine for the computer content. However, you have opened the world of ham radio to me.

Being a CBer 11 years, and watching it go downhill, well, I no longer have a CB. Several months ago I purchased a Hallicrafters S-120. This and your magazine made me decide to try.

I borrowed some 05 Charlie (radio operator) tapes from a friend. I am also interested in learning more about how the radio works.

Anyhow, I want to thank you for putting out such a good magazine. It has helped me quite a bit. Keep up the good work.

Michael P. Olbrisch
APO New York

SKIPLAND

I was into CB before I got into amateur radio, and still do both. With all the Novices and Techs now working the Novice bands, I am surprised at the lack of activity on 10 meters. The problem must be no one knows when the band is open. For the hams with CB rigs, better yet SSB CB rigs, if there is any opening at all, you will hear it on channel 16 lower sideband. When I hear skipland on 11 meters, I go to 10 meters and usually make a contact or two. Hope this stirs up a little more activity on 10 meters.

Leon R. Harris WD8BYM
Battle Creek MI

And the Novices shall lead them. — Ed.

TIMES CHANGE

I think I will let *73* go for a year or so. I first subscribed due to an interest aroused by a pile of back issues from the late 60's — the magazine had a different spirit then. There were a lot of articles for beginners, written in a way that encouraged the less knowledgeable hams to become involved in good stuff like construction. Building — sometimes that's *all* there was. While *QST* was laying out all the mathematical formulas for calculation of the celebration of the angle of the disinclined pandemonium, *73* was telling us about the projects we could have on the air by Wednesday night (well, Thursday afternoon, anyway).

The magazine that arrived in response to my subscription didn't remind me much of the old *73*. The thing that struck me as most out of place was the obsession* with computers. They obviously have some application in amateur radio technology, but enough's enough.

That you would finally publish a computer magazine was a foregone conclusion — I'm sure it will set the pace for the hobby computer crowd. I'm wondering what will happen to *73* once you get fully occupied with *Kilobaud*. I'll be glancing at someone else's issue from time to time to find out.

K.W. Farlow WA3DBL
Wilmington DE

*That word wasn't used as an epithet. You, of all people, would probably agree that a moderate amount of obsession is better than some other things one could mention.

Built a circuit with a CK722 yet, Farlow? Times change. — Ed.

BACK TO BASICS

I would like to congratulate you on the type of articles which appeared in each issue of *73* during 1976. For the most part they were superb, and I will readily agree that same was far ahead of *QST* for the same period.

Also, you are absolutely correct in guessing that my interest in computers has grown steadily through the past year, but one thing bugs me. In several issues of *73* during 1976, there were articles on learning the machine or basic language needed to program a computer and at least one article describing how to use a Model 15 teleprinter for a readout device, and one page of the "Holiday" issue lists various publications beneficial for use after you have built a computer or acquired one. BUT, to my knowledge, there has not been a SINGLE article on how a beginner or experimenter can build his first basic fundamental computer. Please correct me if I am wrong.

Popular Electronics in their August, 1976, issue gave what appears to be a very good article on building the "ElF" basic computer and promised future articles dealing with readout devices, but to my knowledge none has appeared.

I have on order Texas Instruments' computer manual for beginners and the advertisement says the manual describes how to build a basic "machine."

Would it be violating house rules to tell me if an article on "computer construction" is forthcoming in an early issue of *73*?

I have E & L Instruments' "Digi-Designer" and also their "Breadbox," which I find to be of tremendous help in building up test circuits such as were in "How Do You Use ICs?" and other similar articles in *73* for 1976.

Again, congratulations for a job very well done in 1976, and I am convinced that the 1977 issues will be of the same breed.

John W. Yochum W9URQ
Princeton IN

Authors, take note! — Ed.

THE AVERAGE HAM

Would like to see fewer articles on computers, etc., which are written at the level of graduate engineers, and more articles of interest to the average ham, especially those who are relatively new to amateur radio. I like your propagation forecasts.

R. C. Mader WN4AGT
Englewood FL

Try Kilobaud, *OM. — Ed.*

ACCELERATED FUROR

I just simply had to write and say that I enjoy *73* so much! Being a student confronted with an ever-increasing financial crisis, I have had to systematically eliminate "unneeded?" items with an accelerated furor. *73* gets passed over every time (I'm sorry to say I can't say the same for other magazines). I have enjoyed reading the various letters from readers for quite some time and now feel a need to make a few comments of my own.

I really can't see the reason why some readers look down upon, or only simply tolerate, the various I/O articles in *73*. As I see it, a ham who enjoys his hobby and takes it and himself seriously can't afford not to be even remotely interested in the truly fascinating area of microprocessors. For example, a ham who is active in any two, three, or four of the various aspects of ham radio such as RTTY, DXing, CW, Contests, OSCAR, and EME could save a bundle in $$ as well as space by integrating most of the peripheral equipment needed for these various modes into one unit. Enter the microprocessor! Load a cassette and you have an FSK converter, generator, and display. Another program and your EME antennas are aimed at the moon and follow it across the sky. Run another program and you have a contest keyer/memory and a good log. How about a digital signal processor for those weak DX signals down at the low end?

Sure, you might have to learn something about the uP, but we all had to learn something about electronics before we got our ham tickets, too! The next time you find yourself down at one of the radio shops, make a physical movement with your arm and pick up one of the books on microcomputers (pay for it, though!). I guarantee it will be the first of many devoured before you have been even

partially satiated. All I can say is that a modern ham station utilizing a microprocessor for control of its various operations results in a very powerful system to be sure, one that many a non-ham computer buff would be envious of.

Thanks for a good magazine.

Scott G. Turner WB2DLE
Princeton NJ

I/O HELP

73 is responsible for getting me interested in microprocessors and I have ordered my SC/MP and 8K of memory from a couple of the advertisers in your magazine. But many basic questions are starting to bother me. For instance, I want to make the busing system compatible with the Altair bus system so I can use boards and peripherals made for these systems. Can I make the bus in such a manner and then wire the connections for the SC/MP to work or is the SC/MP busing totally different? I guess what I want to know is more on microprocessor hardware in general. I know some of my questions will be answered by the National manual with the kit, but I still need more. What does a computer do when it receives a command to AND the accumulator or to Exclusive OR the accumulator? This I do not know either. Can you recommend any good reference material on these subjects, hardware and machine programming?

One more question, or two really. I have purchased the keyboard kit from Poly Paks, another advertiser in *73*, and have some questions on it also. The keyboard produces negative logic by using 7404 hex inverters; they are also used to produce TTL compatibility. I am wondering if I can use 7407 hex drivers which would then not invert the logic and give me positive output. The ROM used with the keyboard is an AY 5-2376; the control and shift inputs are not wired and I want to know what input is necessary to cause the ROM to produce a shifted and control output. Can you answer the question or can you give me an address to write where I can get an answer or spec sheet?

John W. Daugherty WB8DEG/ON8II
SSG Radio, TX Site
USA ELM SHAPE
APO NY 09055

Can someone give John a hand here? If you've ever been stuck overseas trying to get information on something like hobby computing, I'm sure you can appreciate what he's going through. I answered most of his questions, but I'm sure he would still appreciate some help. — John.

INSTANT REPLAY

I just got my first issue of *73* after a few months vacation from your subscription lists. I notice that there is some debate concerning the I/O section. Some of those letters sound like an instant replay from a few years ago.

I can remember back in 1969 when I put my Motorola 5-V in the car and got on 2 meter FM for the first time. I was in Des Moines, Iowa then — FM may have been big on the coasts by '69, but in the Midwest there were just scattered pockets of activity around the cities. Everything was on 94. You worked through the repeater on 34/94 when you wanted to play with the new toy (it was in some guy's basement, I think — very primitive and experimental), but if you wanted to understand the other station's audio, you switched to 94 simplex. The signals were usually stronger on simplex anyway!

The point is that we were more or less shooting in the dark back then as far as repeaters were concerned, and about the only place to get information and any ideas at all from repeaters in other parts of the country was *73*. I used to get a chuckle every month reading letters from those "old goats" who kept telling you (and us) that there was no future in FM and that you should get back to printing articles on "real" ham radio.

Now it's microprocessors. I have to admit that I was one of the "old goats" myself this time. I was upset with *73* because all of my precious FM and repeater articles were being shoved aside for computers (or so it seemed). Since you weren't into "real" ham radio anymore, I let my subscription drop.

But now we're talking about computer control for our repeater, and those little uP chips have been showing up in ovens, sewing machines, even cars. Some of the local hams who work for the big electronics outfits here assure us that they'll be in just about everything soon. Maybe your present transceiver works without one, but you can bet a uP will be the heart of your next one! Not to mention a dozen other things in the shack that will be controlled by them.

So I'm back, Wayne, and I can sit and chuckle again about the guys who'll be out in the cold when computers revolutionize our hobby. It's going to be soon.

Mark Johns WAØRGV
Minneapolis MN

THE UNINFORMED

I have been reading the letters from others for the last few months and am tired of hearing the same old thing, that is, that *73 Magazine* is all computers and no radio. Just did a bit of research and came up with some interesting figures on the subject which you might want to pass along to the uninformed.

I also took the data for the entire year of 1976 from the master index printed in the Holiday issue and it bears out the fact that *73 Magazine* is still very much a ham magazine and not a magazine for the microprocessor users as many would like us to believe. There were 493 major articles listed in the index for 1976 of which only 48 were "I/O" or 9.736%. In the areas of receivers, transmitters, FM, VHF, antennas and mobile operation, there were 140 major articles or 28.397%. The 140 articles do not include such things as commercial equipment, construction, theory, new products, Novice, power supplies, RTTY, ATV, SSTV, surplus, test equipment, or touchtone pads, which will increase the total to 343 major articles or 69.57% of the total.

It seems to me that when a person is condemning a magazine, they should take the time to get their facts straight, as it only took me about ten minutes to add up all the numbers, which does not seem to be much to ask.

There, I feel better now. Keep up the good work on the magazine and keep the I/O articles coming as every thing new that comes out is always a help in understanding our hobby. The I/O articles help broaden my knowledge of electronics in general and thus broaden my knowledge of ham radio.

By the way, I am in the process of preparing an article for a later issue covering the field of converting the 23 channel CB rig to ten meter operation. With the shift in sunspot activity, ten meters will be the DX band that it was back in 1948-1952 when I was working the world with 5 Watts.

Bob Wilder W4NVH
Theodore AL

I'm waiting for the article. — Ed.

KEEPING UP WITH THE TIMES

Perhaps Doug DeMaw W1FB, *QST* Technical Editor, should read *73 Magazine* to keep up with the times. In the December issue of *QST*, his article titled "Measuring Transmitter Power" says the following: "Perhaps it is time for some manufacturer to develop a directional wattmeter which can be used to read both power characteristics — Average and Peak ..." For Mr. DeMaw's information, such a meter has both been already developed, and is also advertised in *73 Magazine*. It is the Swan WM 3000, which does exactly what the Technical Editor of *QST* wants. And I might add that keeping up to date means that articles published will be up to date, and this is what readers want in the magazines they pay their hard-earned money for. To me, *73* not only keeps up with the times, but stays ahead of them.

My reason for writing this as a letter to the editor is that I am quite fed up with the poor quality of articles in *QST*, their verbosity, and this is a prime example of their own editors not even knowing what's what.

William Vissers K4KI
Cocoa Beach FL

I've been saying that for years. — Ed.

	Dec. 1976 Issue	Holiday 1976 Issue	Jan. 1977 Issue
I/O Articles	5	7	7
I/O Advertisers	14	14	11
Other Articles	18	48	44
Other Advertisers	85	85	74
Total Articles	23	55	51
Total Advertisers	99	99	85
% I/O Articles	21.74	12.73	13.73
% I/O Advertisers	14.14	14.14	12.94
% Other Articles	78.26	87.27	86.27
% Other Advertisers	85.86	86.86	87.06

VEAL CURRY

Would you please have a building article in a forthcoming issue of *73* which is for an LED digital clock which presents time in the 24 hour mode? In addition to being powered by an ac power supply, incorporate a secondary supply (battery) in case of power (ac) loss.

Secondly, how can I get the recipe of the veal curry which Wayne Green spoke of in the Editorial?

L. A. Watts WBØWOD
Colorado Springs CO

Veal curry? Sure. Sautee 4 diced onions; when slightly browned and tender, add 2# veal cut into small cubes (about 1") and sear the veal. Salt ... pepper ... 2 tablespoons of curry powder ... add garlic (about two cloves cut up fine) ... then add a cup of white wine (doesn't have to be all that good wine); cover and simmer for about 50 minutes. Add more wine if the level gets low ... you want to have plenty of gravy, you know. Mix 2 heaping tablespoons of flour and a half cup of cold water and add slowly to the curry to make the gravy. Simmer a bit longer, stirring to keep it from sticking. Salt to taste. If you like a "hot" curry, add some red pepper.

You'll want some condiments. Small dishes of these are passed around the table and sprinkled over the curry and rice. Oh yes, the rice ... make some white rice ... put the curry over it when you serve ... then everyone can sprinkle the condiments as they please on top of the curry.

Condiments: crushed pineapple (Hawaiian, if at all possible ... not Taiwan, Philippines, etc.), chopped peanuts, shredded coconut, toasted coconut shreds or chips, raisins which you've simmered a while to plump, Major Grey's Mango Chutney, chopped hard boiled egg, some people like shredded toasted bumalo fish (known also as Bombay Duck), but I hate the stuff, chopped well-done bacon, chopped dill pickles.

That should feed four well ... and you won't forget it. — Wayne.

Continued on page 104

Jim Trulove WA7ABV
2345 W. Kathleen Rd.
Phoenix AZ 85023

A New Breed of Voltage Regulators

- - throw away your old 309s

Amateurs are probably building more electronic circuits today than ever before. With the multitude of IC circuits that are available these days to do complicated functions, frequently one has little more to do than build up the manufacturer's recommended circuit to complete his project. However, in breadboarding these new circuits, one piece of equipment that is an absolute must for the test bench is a good, well-regulated power supply.

Several manufacturers have offered three-terminal fixed voltage IC regulators for some time. These ICs just about took all of the work out of power supply design, as long as you only wanted one fixed power supply voltage. However, making up a variable supply was a little messy.

Well, designers at Fairchild Semiconductor[1] realized many IC users require voltages other than the ones that they had standardized for their series of fixed voltage regulators. So they recently introduced two new IC circuits that fill in the gaps in their series of fixed voltage regulators. These two circuits are the 78MG positive regulator and the 79MG negative regulator.

This article will introduce basic circuits for using these two ICs at fixed voltage levels, as well as for variable power supplies. As with most IC circuits, it doesn't do to simplify, so we will also show some of the pitfalls to avoid.

[1] Fairchild Semiconductor, 464 Ellis Street, Mountain View CA 90402.

Features

The 78MG and 79MG variable output voltage regulators offer unique features which make the circuits very simple to use, while providing protective features which are hard to obtain in a discrete design.

The most outstanding characteristics of these IC regulators are protection against output short circuits and protection against excessive power dissipation. These features make the regulators difficult if not impossible to destroy through misuse. A third related characteristic limits the ICs' output transistors to safe area operation.

The regulators are designed to supply up to 500 mA of current, with input voltages in the range of +5 to +35 volts for the 78MG, and -2.2 to -30 volts for the 79MG. The maximum input voltage for either is 40 volts.

The devices are packaged in what is called a "mini-batwing four-terminal package." The wings on the package allow the device to be secured to a heat sink to increase power dissipation capabilities. Both devices feature line regulation of 1% when the input voltage is varied from 7 volts to 35 volts, and load regulation of 2% when the load current is varied from 2 mA to 500 mA. The quiescent current is 2.5 mA, and the regulators require a minimum of 2 volts margin between input and output to stay in regulation. The power dissipation is internally limited to 7.5 Watts.

The older three-terminal, 78 series fixed voltage regulators had an internal voltage reference which was sensed through a resistive voltage divider network. The ratio of resistance in the voltage divider network was preset internally when the chip was manufactured. The 78MG and the 79MG regulators use the same concept, except that there is no internal voltage divider network. Instead, this point is brought outside the package by means of a fourth pin. Thus, all you have to do to set the regulator for any

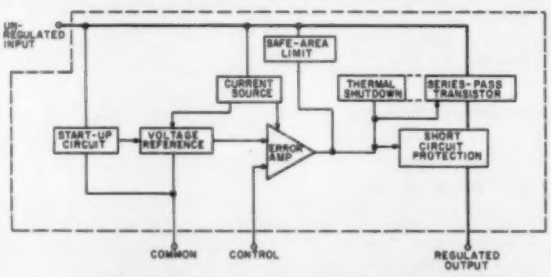


Fig. 1. Block diagram of the 78MG/79MG regulators.

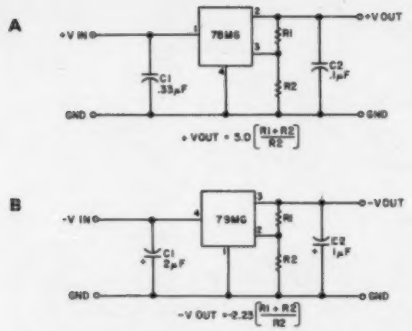


Fig. 2. Basic regulator circuits. (a) Positive regulator; (b) negative regulator.

voltage within its range is supply two resistors of the proper value to supply the feedback voltage to this fourth terminal.

It is the addition of this fourth terminal which meant that the familiar three-terminal, power tab package had to be abandoned in favor of a four-terminal package. The package that was chosen is basically a stretched out four-pin plastic dip package with two "wings" protruding from each side for a heat sink.

The Insides

Fig. 1 shows a block diagram of the 78MG and 79MG regulators. The internal structure, with a few minor refinements, is identical to that of the earlier three-terminal regulators. The major exception is that one input to the error amplifier is brought outside the package so that you can supply any reference voltage you wish.

Let's get a brief idea of internal circuit operation before we get caught up in applications. The start-up circuit contains a zener diode and two transistors which have the purpose of bringing the circuit into initial regulation. After it is in regulation, the start-up circuit is biased off. The error amplifier compares the voltage at the control input to the internal voltage reference and generates an error signal of the proper polarity if the two voltages are not the same. This error signal either increases or decreases the bias current into the series pass transistor, which in turn increases or decreases the regulated output. The safe area limit and thermal shutdown circuits provide protection against normal operating overloads. The short circuit protection reduces the current available to the series pass transistor in the event of an output short circuit.

The regulators also contain a 30 pF MOS capacitor to increase stability and lessen the possibility of oscillation. The regulators achieve thermal stability through careful balancing of positive and negative temperature-coefficient components.

Basic Regulator

Fig. 2 shows the simplest configuration in which the positive and negative regulator can be used. This is really all you need to place in front of an unregulated power source in order to produce a stable well-regulated voltage source. The input capacitor, C1, is necessary to stabilize the regulator under all possible conditions. Although the manufacturer lists this input capacitor as an optional item "needed only if the regulator is located more than a few inches from the unregulated supply filter capacitor," I would very strongly suggest always including it. For the few pennies of extra cost, you may save yourself from destroying a regulator chip. It also allows you a lot more freedom in locating the unregulated source, and in choosing the unregulated supply filter capacitor.

Conversely, C2, the output capacitor, is really not necessary for regulator operation, although it does tend to improve transient response. I would suggest, if you intend to use the regulator to supply power to switching loads, such as TTL circuits, you would be well advised to include an output capacitor of approximately the value shown. One further comment about output capacitance: If there is any chance that you might drive a very large capacitive load (e.g., as large as the unregulated supply filter capacitor), you must provide extra protection for the regulator to prevent possible destruction of the chip. A diode in series with the output, large enough to handle all the output current, will provide quite adequate protection from reverse voltage. In all cases, the application of a reverse voltage between the output and input pins of the 78MG and 79MG regulators must be avoided.

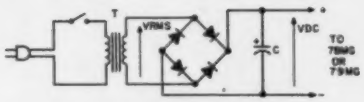


Fig. 3. Unregulated supply.

You might notice that the input and output capacitors of the negative regulator are larger values. The larger values are required to maintain the same level of stability as the positive regulator. The formulas for calculating the output voltage are given in the figure. The two constants of +5.0 and -2.23 are the magnitudes of the internal voltage references and represent the lowest obtainable regulated voltage. If a pot is used in place of R1 and R2, an additional fixed resistor should be included in the ground leg of the pot. This linearizes the relationship between the rotor position of the pot and the

Vrms NOMINAL TRANSFORMER SECONDARY VOLTAGE (Vrms)	Vdc AVERAGE DC OUTPUT VOLTAGE (Vdc)	Vout DESIRED REGULATED OUTPUT VOLTAGE (Vdc)	I1 MAX. LOAD CURRENT (Amps)	C1 MIN. CAPACITOR SIZE (Microfarads)
6.3	8.2	2.23* to 5.3	0.5	1200 @ 20 V
		2.23* to 5.3	1.5	3600 @ 20 V
		2.23 to 4.5*	0.5	600 @ 20 V
		2.23 to 4.5*	1.5	1800 @ 20 V
12.6	16.3	2.23* to 12.5	0.5**	600 @ 35 V
		2.23* to 12.5	1.5	2000 @ 35 V
		2.23* to 11	0.5**	300 @ 35 V
		2.23* to 11	1.5	1000 @ 35 V
25.2	32.8	5 to 29.5	0.5**	300 @ 75 V
		5 to 29.5	1.5	1000 @ 75 V
		5 to 26	0.5**	150 @ 75 V
		5 to 26	1.5	500 @ 75 V

*This voltage is obtained only with 79MG.
**If the 78MG/79MG is used without an external pass transistor, full current may not be available for lower output voltages, since the IC will limit power dissipation to 7.5 Watts.

Table 1. Component values for the unregulated supply shown in Fig. 3.

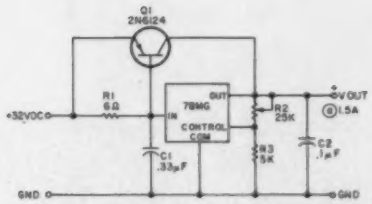


Fig. 4. Adjustable regulator, 5 to 30 volts at 1.5 Amps. Q1 should have a large heat sink, preferably in common with the 78MG. Be sure to electrically isolate Q1 and 78MG.

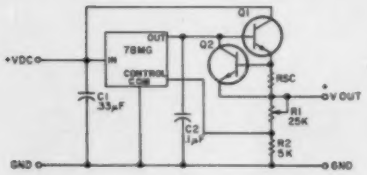


Fig. 5. High current regulator has short circuit protection set by value of R_{SC}.

output voltage. In fact, if you use a fairly accurate linear taper pot, there is no need for an output voltmeter; just mark off the pot rotation in equal increments, and you have a nice permanently calibrated variable voltage source.

Every regulator needs an unregulated supply. Fig. 3 shows a supply suitable for most general purpose work. Values are shown in Table 1 for two common voltage ranges. As a rule of thumb, I like to be generous with voltage ratings on large filter capacitors. Not only are the large-valued capacitors more susceptible to failure near their rated voltages, but many inexpensive, low voltage transformers greatly exceed their nominal output voltage at low current levels. Another important item to keep in mind is that the safe area limiting circuit of the voltage regulator IC begins to operate when the voltage across the series pass transistor exceeds 8 volts. This circuit interacts with the short circuit protection transistor to limit output current. Thus you may not be able to take advantage of all the available output current rating of the regulator if the differential between unregulated input and regulated output voltages is too great. Another important point to keep in mind is that, for proper regulation, there must be a minimum of two volts differential across the IC regulator. This, of course, means that your unregulated supply must provide at least two volts more than your desired output voltage.

Other Circuits

If you're like most experimenters, a 500 mA regulator is fine for a small supply for most projects. However, it's not nearly enough for your main lab power supply. What's needed is more like 1 to 2 Amps of output current.

Increasing the current output of the 78MG and the 79MG regulators can be done simply by adding an external series pass transistor and a biasing resistor. This hookup is shown in Fig. 4 for currents of about 1.5 Amps. This circuit, however, provides no short circuit protection or safe area limiting for the external pass transistor. Thermal overload protection of a somewhat lesser degree can be provided by mounting the pass transistor and the 78MG in close proximity on the same heat sink.

To regain short circuit protection for the external transistor, an additional small signal transistor and current-sensing resistor are required. For my bench power supply, I use the circuit shown in Fig. 5. This connection uses an NPN transistor for the external series pass. The collector of Q1 can be tied either to the unregulated input to the 78MG, or to some other positive voltage. This means you can use the 78MG to control a much larger voltage than it could ordinarily handle. The limiting factor then becomes the breakdown voltage of Q1.

Since the output circuit is proportional to the voltage across R_{SC}, that voltage may be used to indicate output current. A simple metering circuit can provide a measurement of the load current. Of course, current will be drawn by R1 and R2 even when there is no load current being drawn. However, this current should be negligible in comparison to the normal supply current used.

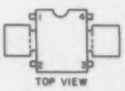
Pin Connections

Fig. 6 shows the terminal connections for the four-pin mini-batwing IC package. Note that the functions of pins one and four and pins two and three are reversed between the positive and negative regulators. This is a really clever idea that the fellows at Fairchild came up with to prevent damage to a regulator should it be plugged into a circuit for a regulator of the opposite polarity. Reversing the terminals prevents the IC from being reverse biased and probably destroyed. Thus if you plug one into the wrong socket, nothing disastrous will happen – the IC just won't regulate.

The 78MG and 79MG regulator ICs are presently available in two main mini-batwing configurations. The T1 package has the batwings bent downward so that they can be inserted into a PC board slot and soldered down. The T2 package has the leads bent slightly downward and then out horizontally, so the wings can be bolted to the PC board or heat sink. Heat sinking is quite important, as the internal protection circuitry will shut the regulator down if power dissipation exceeds 7.5 Watts.

Summary

This article, hopefully, has presented information sufficient for building a wide variety of regulated power supplies for general project use. These ICs have just been released by Fairchild, and should be readily available through factory distributors by the time this is printed. I fully expect other manufacturers to "second source" these regulators, just as they did the original 7800 series of fixed regulators. The price on the 78MG and the 79MG should be around $2.50 each. These circuits should really make it simple to build a highly regulated power supply at low cost. ■



78MG Positive Regulator		79MG Negative Regulator	
Pin 1	+ INPUT	Pin 1	COMMON
Pin 2	OUTPUT	Pin 2	CONTROL
Pin 3	CONTROL	Pin 3	OUTPUT
Pin 4	COMMON	Pin 4	- INPUT
Wings	COMMON	Wings	- INPUT

Fig. 6. Regulator pin designations. It is a good idea to electrically isolate the batwings from the heat sink. The wings are internally connected to pin 4 of the package, which means that they are at the same potential as ground in the 78MG, but at input potential in the 79MG.

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73 magazine Peterborough NH 03458 3/77

I/O EDITORIAL

by Wayne Green W2NSD/1

Microcomputers are two years old, practically speaking. Though a few experimenters were messing around with the Intel 8008 a little before the Altair 8800 system was announced in January, 1975, there was little available in information or hardware. The Altair, launched with a lot of publicity and advertising, got the whole field going and fired up a new breed of hobbyist.

Now, after two years, perhaps we have enough perspective to get a handle on what we have and where we may be going.

In some ways, there has been a great deal of progress; in others, not much has changed. There are now over twenty different microcomputer systems being made for the hobbyist, and well over 150 different compatible boards for the Altair bus. There are over 50 computer stores around the country helping to sell these systems to hobbyists.

In the "not much change" area is programming. It took about a year for the first computer language to be made available ... BASIC. Some systems still don't even have that much for the user to work with. There are a few games available and a couple books of business and scientific programs, but not a lot else. Magazines such as *Kilobaud* are starting to bring more programs to users, but this aspect of computing has been slow to develop. Higher level languages such as FORTRAN and COBOL are still not generally available for the microcomputers, so the use of these systems is still quite limited.

Many of the early hobbyists started building a computer kit without reading the fine print (so to speak) and they gradually discovered that a CPU does not a computer make. Their $500 CPU looked fine, but it wouldn't do anything until $1000 or so of memory was put in the box. Then they had to hook on a printer or a video terminal, another $250 to $900 out of pocket. Now, with about $2000 invested, and Altair BASIC up and running, they could play hangman or lunar landing games. Star Trek needed another $500 in memory ... sorry about that.

Hobbyists needed some medium to store programs and to record data for the computer to use. The first choice was the cassette recorder, and every manufacturer of microcomputers promptly came out with a different system, making it so no two hobbyists with different systems could swap programs or data. This situation is still up in the air, with no system as yet satisfactory enough for the industry to accept it.

Business had long been using floppy disks, and some eventually were made to work with the hobby systems. They are still rather expensive for the hobbyist, prone to mechanical problems, and not supported with very much in programs to make them do a lot.

The hobby market has not been a large one, so most of the firms involved have been very small. There are a little over 10,000 hobby computer systems up and running so far, according to the best estimates. The readership of the hobby magazines (such as *Kilobaud*) make it plain that there are about 50,000 or so people who would like to get systems, but have been waiting for more information before getting their feet wet. That's a $100 million market, so it's well worthwhile for the small firms to court.

Even bigger, by a couple orders of magnitude, is the coming market for these systems. Hobbyists will be paying the costs of hardware development, which should bring us some relatively inexpensive and dependable computer systems which will be sold by the millions to business. We'll be seeing them in every office, in stores, in schools and in homes, just as we see TV today. It's a market that can't fail to come along when the hardware and software are ready.

We radio amateurs have a tremendous advantage in something like this by virtue of our head start with electronics. Most computer folk are programmers, and they are at a disadvantage because the hardware end of computers is much more difficult to understand than programming. Most hams have already read enough digital articles in the ham magazines to be able to understand the fundamentals of computer systems ... they really aren't all that complicated for us. This is why such a high percentage of the pioneers in hobby computing are hams.

Hams have another major advantage over other computerists ... they have some great things to do with their systems once they get them running. The hobby computerist is stuck with a bunch of games and not a lot more to do that can't be done better with a hand calculator ... and more cheaply. The ham can use the computer to run a repeater, to find Oscar, to operate his RTTY station, to simplify winning contests, keep his log, aim his beam for DXing, copy Morse code ... stuff like that ... combining the fun of doing something practical with knowledge that is of immense value in this exploding field.

One of the major needs today is for information. The manufacturers of computer equipment are way behind on their documentation, so we need to help each other. When we figure out how to interface a BCD keyboard with an ASCII computer, we should write it up. When you write a good ham program for your system, pass it along (via *73*, of course). If you will pass along what you've learned to others, we'll all benefit.

Many of the *73* readers work with microcomputer firms ... or with the manufacturers of peripherals ... please try to overcome the documentation lag by writing articles for *73* on the use of these gadgets. We all want to know. If there are any questions on how to write just send for our poop sheet .. or go ahead and do it without said poop sheet ... as long as you double space your typing.

Okay?

KILOBAUD POSTERS

The reader reaction to the first issue of *Kilobaud* is coming in and it is most gratifying. The most often complimented is the choice of articles ... they are by some of the top people in this new field, so it is no wonder that they are good reading. Expert writers are somehow able to write so beginners can understand.

The type is set pretty much like *73*, so there are a lot of articles in the magazine as compared to the other magazines ... 22 of them in the same space where another magazine gets in 14. More for your money, you might say. A few *73* readers have noticed that articles in *73* are far more compact than those in the other ham magazines.

The hobby computer field seems to have settled down to two main magazines ... *Kilobaud* and *Byte*, with *Byte* aiming at the computer scientist and *Kilobaud* at the beginner. *Microtrek* hasn't been seen since August. *SCCS Interface* and *Interface Age* seem bent on mutual self-destruction, with lawsuits and other time and money wasting jazz. This has left both magazines very scant on material.

The posters? Oh yes ... we've got some posters which we hope will interest more people in reading *Kilobaud* ... and we're hoping you'll dip in an oar to help. We'd sure like to get these posters hung up where they might bring in subscribers ... places like schools with computer science departments. A student is going to be far more valuable to himself and to anyone he works for if he is not only a professional, but also a hobbyist. We've seen that in amateur radio for years.

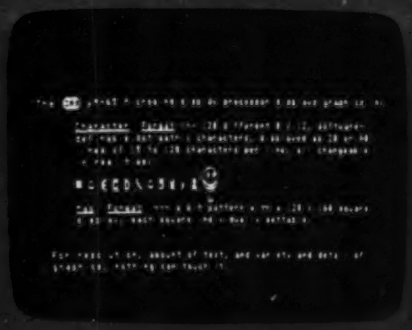
An employee of a firm making computers, accessories, or even a software firm will be far more valuable if he has the initiative to learn on his own. A subscription to *Kilobaud* could provide this impetus. Thus we'd like to have *Kilobaud* posters in as many firms involved with computing as possible ... the firms will benefit from it ... a lot.

If you have a school or business to spot one of our posters, please drop a note to marketing director Sherry Smythe and we'll get one off to you, complete with a bunch of subscription cards attached.

FREE SUBSCRIPTIONS

Bruce Seals called recently to say that he wants to see what will happen if he offers a free subscription to *73* with every direct sale of an 8K memory board ... either the 500 ns model at $269 (special) or the 250 ns model at $295 (also special). I tried to think of a good reason not to — couldn't. I did suggest that he offer an alternate of our three microcomputer books as an incentive for readers who were life subscribers, and he agreed to that. Either one is a $15 value ... so if you find yourself ordering an 8K memory from Seals you might mention whether you prefer a year of *73* or the three computer books: *Hobby Computers Are Here, The New Hobby Computers*, and *Microcomputers Simplified!* Bruce will take it from there.

WATCH FOR 73's "THE NEW COMPUTERS"!



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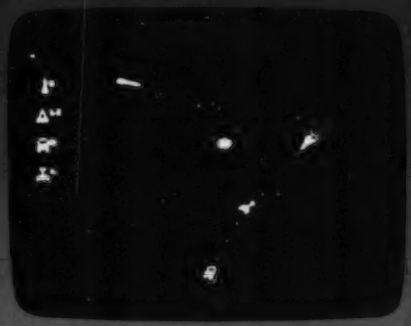

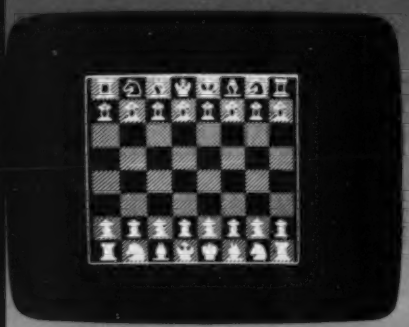

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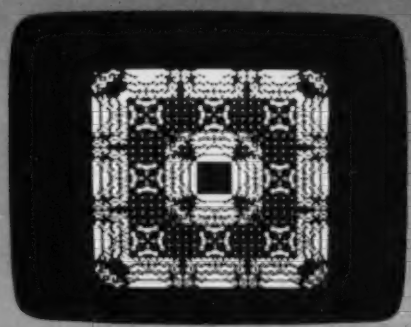

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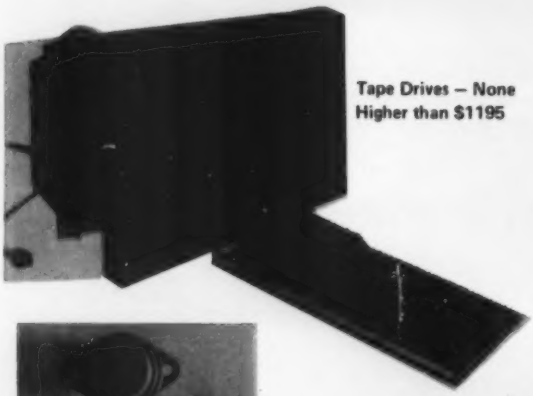

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I/O REPORT

by John Craig

I'm sure that it must sometimes sound like Wayne and I are broken records when it comes to talking about articles. But it's downright sad that there are still so many areas in ham computer applications which haven't been written up as articles. Naturally, if we keep bringing up the subject, there's a good chance we can get the right people fired up and get the material you want to read. I know the problem isn't that articles on computer applications are going to *Ham Radio* and *QST* . . . it's just that the people out there doing things aren't taking the time to sit down and write about them. If the fame or the sharing theme isn't one these folks can relate to, then the money certainly should be.

Now . . . how about some ideas?

There are still a lot of hams looking for fundamental material on both the hardware and software of microcomputer systems (and they're going to be looking for it in the I/O section). How to use an assembler, programming techniques in both assembly language and BASIC, and hardware interface considerations are just a few examples of the type of material needed.

We still haven't seen any good articles on troubleshooting techniques for microcomputer systems. This is something that could easily be a series of articles. There are different troubleshooting approaches for different problems (CPU, memory, I/O). There's a lot to be said with regard to tools (and the selection of the right one for troubleshooting). For example, some oscilloscopes are not suitable for digital troubleshooting because of their bandwidth or the fact that they aren't triggered. And how about using the VOM and logic probe? Something like this should be liberally sprinkled with diagrams, scope waveforms, and photos. I think the best approach would be to have the emphasis on general techniques, with two or three examples.

And how about SSTV applications? I haven't seen anything in this area. The computer can be used for temporary storage of an image (or images) to be transmitted to your monitor later (and at a faster rate). There are surely other applications for microprocessors in SSTV, also.

Did you see the article in the January issue entitled, "A Software Replacement for the Muffin Fan"? Undoubtedly, if you saw the title you read the article (how could anyone resist, with a title like that?). The article discussed a computer-aided design program for determining the need for heat sinks in power supplies. There's no reason why we can't have a complete library of such programs, ranging from basic electronic formulas to antenna design routines. There are a lot of professional engineers around the country who would dearly love to have a personal system sitting in their office with an extensive computer-aided design package running in it. You can have the same thing right in your home!

And, how about equipment reports? They make interesting reading . . . and they aren't that hard to write, either. Just take notes on the good and bad points you encounter when building or using a new piece of equipment . . . generate an outline . . . take some photos . . . then write it up. In some cases, you can actually make as much money on the article as you spent for the piece of equipment.

A couple of months ago I mentioned the need for us all to give more exposure to the world of analog-to-digital and digital-to-analog conversion, so that we could start applying microprocessors in dedicated controller applications. Not only do we need articles dealing with the conversion techniques (and the interfacing to the computer), but we could also use some applications articles in that area.

One subject which we've seen an awful lot of material on (in many publications) is Baudot/ASCII conversion. We need another one. Somebody needs to design a single board for a Baudot TTY/computer interface which will have ROMs for taking care of the code conversion (and also have circuitry to take care of converting from 60 to 20 mA loop current and vice versa). It would make for one fine construction article . . . and also make it a lot easier for people to use those Baudot machines with their computers.

There are certain areas which have been covered sufficiently in the I/O section; these include ham logs, satellite tracking and Morse code conversion. There are too many other areas to be written about for anyone to be sitting around twiddling their thumbs (although I haven't seen too many computer hobbyists doing that!). Quite often there are those who would *like* to do some writing, but just can't get the inspiration or subject that really gets them fired up. Drop me a line if you fall in this category . . . and see just how helpful I can be.

THE COMPUTER FAIRE

Next month . . . the First West Coast Computer Faire will be taking off and rolling like a locomotive, starting April 15th and going through to the 17th. Sure hope you can make it, because it will probably be the hobbyist event of the year. *73* and *Kilobaud* will both have booths there. Attendance is expected to be around 10,000. See you there!

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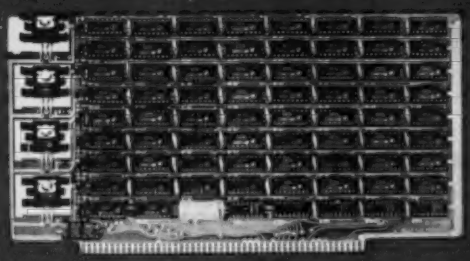

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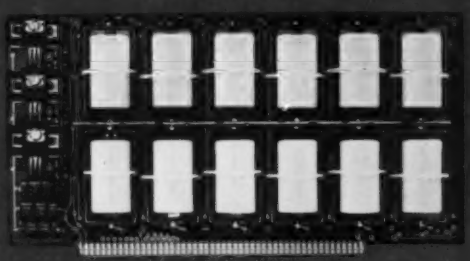

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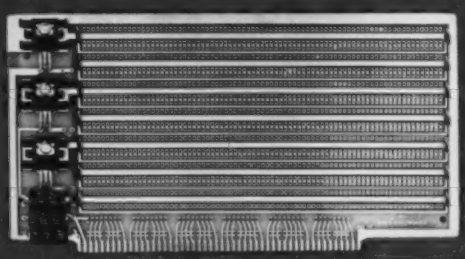

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High Quality Display

- - with complete cursor and video control

Photos by Mike Barnaby

The video display described in this article is a high quality display with large capacity (2048 characters), extremely high speed (normal memory cycles are used to enter or read data from display memory), and unlimited formatting capability. In writing this article, I have assumed the reader has at least a basic working knowledge of digital logic and is familiar with typical uses of a video display.

The display itself consists of 32 lines each containing 64 characters for a total of 2048 characters. The character set includes both upper and lower case characters and the Greek alphabet, in addition to some special characters. Normal display of a character is white on black, but the video may be inverted on a character by character basis to produce a black character in a field of white.

The display memory is accessed directly by the microprocessor as though it were normal memory. This allows information to be written to or read from any location of the display memory at any time. Scrolling the display then becomes a software process, and as such allows the display to be arbitrarily partitioned into several segments, each being scrolled independently of the others. In fact, programs may be loaded directly into display memory and executed.

The display does not, however, steal cycles from the processor (as many who have seen my display immediately ask). Display memory is normally isolated from the processor bus and is used by the display control circuitry in parallel to normal processing. When the processor performs a read or write cycle utilizing a location within the display memory, control of that memory is automatically switched to the processor. This means that the processor steals cycles from the display when needed.

A Basic Video Display

Before I go into a detailed description of my display, I'd like to go through a simplified description of the fundamental process of creating a raster scan display.

A raster scan CRT (Cathode Ray Tube), an example of which is a normal TV set, produces an image by moving an electron beam horizontally across the screen 262½ times (from left to right) while moving it once from top to bottom. On every other vertical trace of the beam, the start of the horizontal tracing is delayed slightly to produce a field of horizontal lines between the lines drawn by the previous trace. Each of the two fields of lines is called a frame. The process of causing the lines of the second frame to fall between the lines of the first frame is called interlacing.

Movement of the electron beam is synchronized by special pulses which are part of a video signal, the horizontal and vertical sync pulses. For instance, suppose that the beam has just completed a trace across the face of the CRT. The horizontal sync pulse will cause the beam to go back to the left side of the tube (retrace) and begin a new sweep. Likewise, a vertical sync pulse causes the beam to move back to the top of the screen. Another part of the video signal is the blanking. Blanking pulses follow each of the horizontal and vertical sync pulses and serve to blank out the retrace of the beam so that it does not show up as unwanted light on the screen. The final part of a video signal is just the video information itself. This information controls the intensity of the electron beam as it is being swept across the CRT. The sync, blanking, and video information are all combined to produce a single signal which controls the CRT monitor.

Producing a display of characters on a raster scan CRT involves only the synchronization of an appropriate train of pulses with the horizontal and vertical information. I have shown a simplified block diagram to accomplish this in Fig. 1.

The clock and timing information block is responsible for generation of the horizontal and vertical sync and blanking pulses. This information is fed directly to a video combiner and is also used to control the operation of several counters. The row counter and the column counter provide an address to the memory (which contains the characters to be displayed). The data from the memory serves as one input to a read only memory called a character generator. The character generator contains a matrix of dots for each character (see Fig. 2). Since only one row of dots for a character may be produced on a given scan of the electron beam, a scan line counter is needed to tell the character generator which particular row of dots is currently being called for. The output of the character generator is loaded into a shift register and

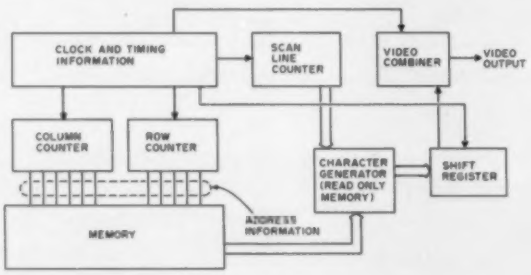


Fig. 1. Video display simplified block diagram.

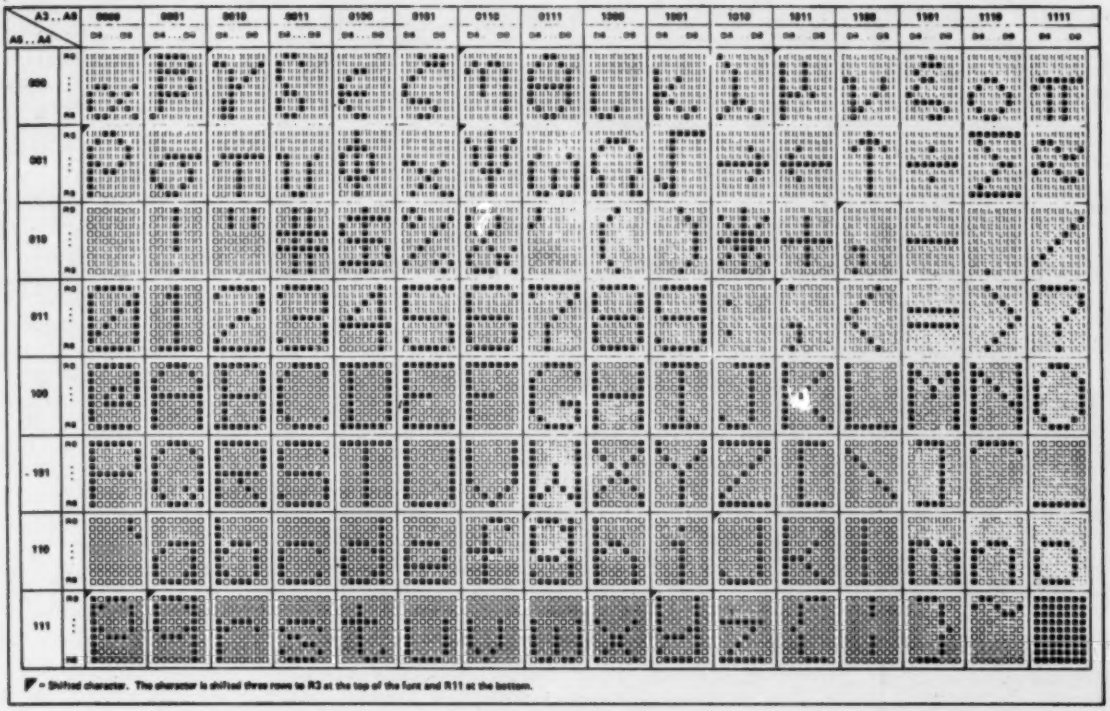


Fig. 2. Character set for the MCM6571A character generator. This read only memory is also available with other character sets.

shifted out to be combined with the horizontal and vertical information to produce white dots on the screen.

My display writes 32 lines of 64 characters per line. I allow 15 scan lines per row of characters. This means that it takes 15 traces of the electron beam to produce one row of characters. A simplified flow of events would be:

1. The system is reset by the vertical sync pulse.
2. Several horizontal sweeps are allowed to happen before anything else to space the characters down from the top of the raster, which is usually distorted.
3. Data from memory is presented to the character generator. At the same time, the scan line counter tells the character generator which row of dots within a character is needed.
4. The output of the character generator is loaded into a shift register and shifted out into the video combiner one bit at a time.
5. The column counter is incremented and the same process takes place over and over until the end of a line.
6. At the end of a horizontal trace, the scan line counter is incremented by the horizontal sync and the same line of characters is presented to the character generator to produce the second row of dots on the screen. This process repeats until the first row of characters has been completed.
7. A few horizontal sweeps are allowed for spacing. Then the row counter is incremented and the above process repeats for the next row of characters (and so on, until all the characters have been completely displayed).

The operation of my display follows this basic outline, except where I have taken advantage of peculiarities within the circuit. I also have had to play tricks because of the interlacing of the two video frames, so that I would have enough scan lines available to produce 32 lines of high quality characters.

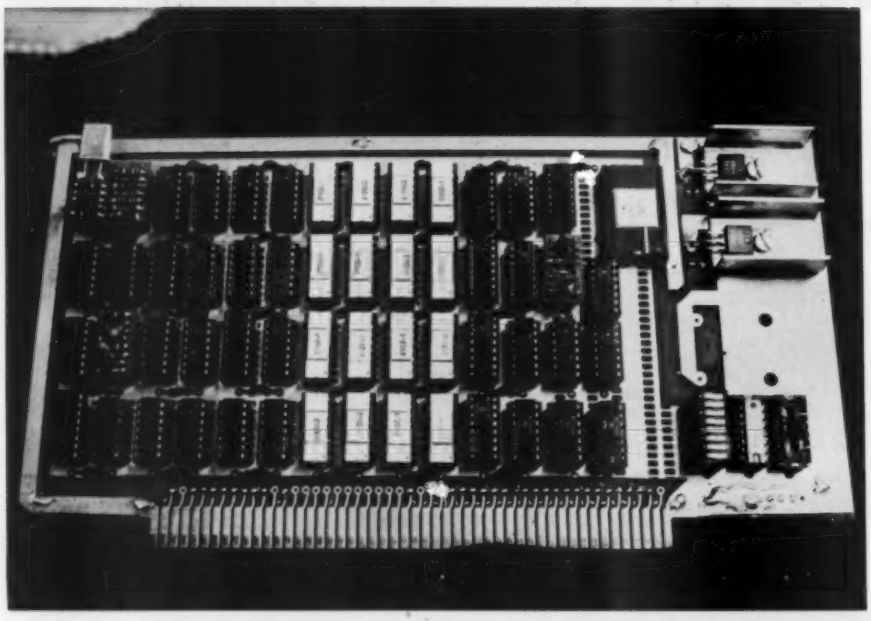
Conventions

For simplicity (at least in the writing of the article, if not in the reading), I have adopted a few conventions in drawing the schematics for publication. First, all crossing lines are *not* connected. Connections are drawn to produce "T" junctions.

A logic gate with an "00" in it is a 7400, one with an "04" in it is a 7404, and so on.

ICs drawn as boxes have their part numbers inside the box.

I have not numbered pin connections on common logic gates; I leave this to the builder, since it is unlikely that his layout will make it convenient to use the same pin numbers. (My display is wire-wrapped. I highly recommend going that way, as a printed circuit layout on this scale would be a great undertaking for the hobbyist.) I have not numbered or shown power connections for any but special ICs. Fig. 3 contains all pin number and power information for the ICs used. Where I have numbered pins on counters, flip-flops, and special ICs, there is little choice (except for the flip-flops which have two gates per package). Numbers in small square boxes refer to Altair bus numbers and are the only off board connections to be made except for the video connection itself. If you are not using an Altair-compatible bus, then you will need to make appropriate corrections to the memory control part of the schematic (note that the only connections to the external world are those appearing on the memory schematic – except for power and the video connection).



Component side of Altair bus video driver board.

The Memory

I'll start my discussion of the actual display circuit by describing the memory schematic shown in Fig. 1, since it is relatively straightforward.

I have used 2102s for memory, since they are cheap and readily available. There is nothing sacred about this choice, and any other memory could be substituted if it were fast enough. I recommend buying memory which is guaranteed to at least 500 nanosecond access time (to insure reliable operation).

The address lines of the memory chips are tied in parallel and connected to the outputs of the 74157 multiplexers, whose function I'll describe soon. Data inputs of the memory are simply connected to the data out bus of the processor. The data outputs of the memory are connected to the character generator (Fig. 5) and to some tri-state bus drivers (74125). The purpose of the tri-state bus drivers is to allow data to be read from the display memory by the processor. If you wish to use another tri-state gate (such as an 8T97), it will make no difference.

The memory control circuit serves to distinguish between valid memory requests and random states of the Altair bus which occasionally look like memory requests if enough care is not taken. The gates in the upper left of the memory schematic decode valid processor requests for the memory by monitoring three status lines and five address lines. If SOUT and $\overline{WO}$ are both low, then the processor is about to write to memory. If MEMR is high, the processor is about to read from memory. If, at the same time, address lines A11 through A15 are high, then the byte of memory being addressed is within the two kilobytes of display memory. One half of a 7474 flip-flop is used to latch the request status during sync time of the processor, with the 0_1 clock being used to clock the flip-flop at a time when all address and status signals are stable. While my display memory is located in the high order two kilobytes of the Altair's memory addressing range, it is by no means a sacred choice. You can put your display memory anywhere you wish by appropriate decoding of A11-A15.

When a valid processor request has been decoded and latched, the three 74157 multiplexer chips shift control of the memory address lines from the display's own counters to the computer's address bus. The MWRITE Altair bus signal is gated by the output of the request latch to allow the processor to write data into memory. Similarly, the MEMR signal is gated with the output of the request latch to enable the tri-state bus drivers for a read cycle.

Address bit 2^{10} (from the multiplexers) is used to enable either the high order kilobyte or low order kilobyte of display memory.

When the processor is finished with its request for use of the memory, the multiplexers shift control of the memory back to the display control.

The Character Generator

Before I get into the actual description of the control schematic, I would like to take time to go over the character generator I chose and attempt to explain why I did some of the things I did with the control circuitry.

The character generator stores a 7 x 9 matrix of dots for each of its 128 characters. Some of the characters (like j, y, g) should extend beneath the line for best results, so the character generator contains circuitry which shifts the matrix automatically on such characters. What this means is that for a normal character, the dots of the character will appear when lines 0 through 8 of the character generator are addressed. For a shifted character, lines 0 through 2 will come out blank and the 9 lines of the matrix will appear when lines 3 through 11 are addressed. In addition, if lines 11 through 15 are addressed, blanks will result at the output.

What this really means is that from the designer's viewpoint I don't have to know that the information is stored in a 7 x 9 matrix. I can make believe that it is in a 7 x 16 matrix where the last four lines are always blank. Motorola, I love you for the MCM571A!

I use 15 scan lines per row of characters in my display (originally I used 16 but could not achieve 32 lines of characters). Multiply 32 lines of characters by 15 scan lines per character line and you get 480 scan lines (see how nicely the units cancel – high school physics, eat your heart out!).

Now, remember from my earlier discussion that there are only 262½ scan lines per frame. Since I need 480 lines, I must use the fact that alternate frames are interlaced by causing my control circuitry to do every other scan line and alternate between frames. Since I am using 15 scan lines per character line, I must in one frame write the eight even number lines of the first row of characters, then the seven odd numbered lines of the second row of characters, the even of the next, etc., etc.

In the next frame, I must start with the seven odd numbered lines of the first row, the eight even numbered lines of the second, and so on. I

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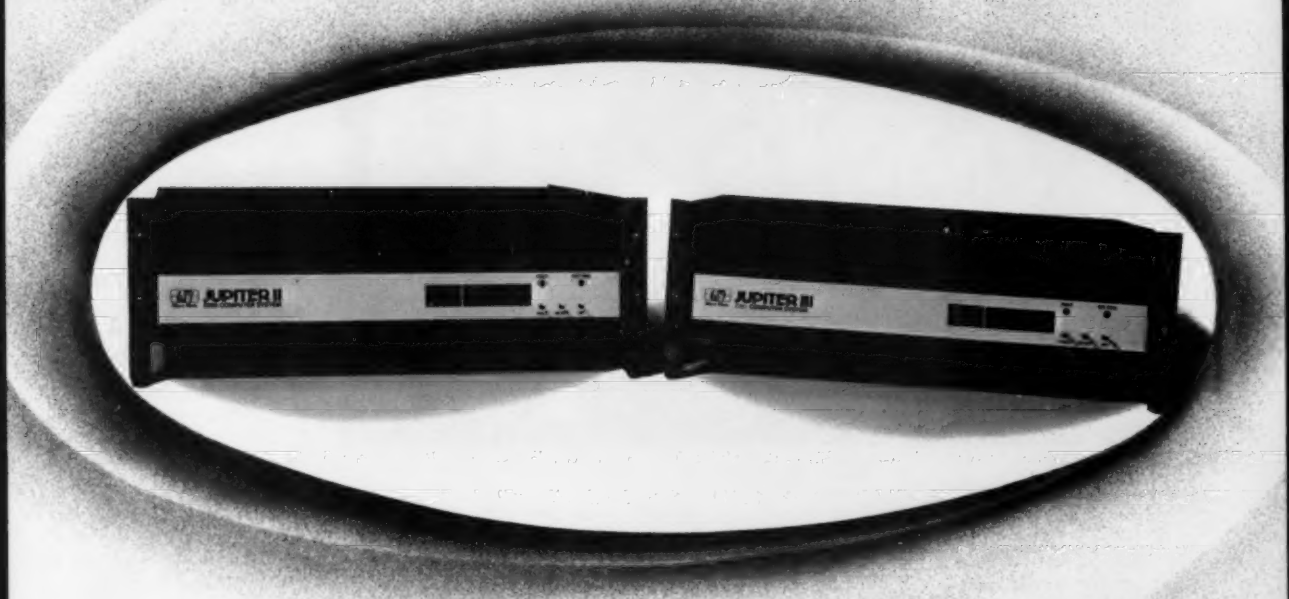

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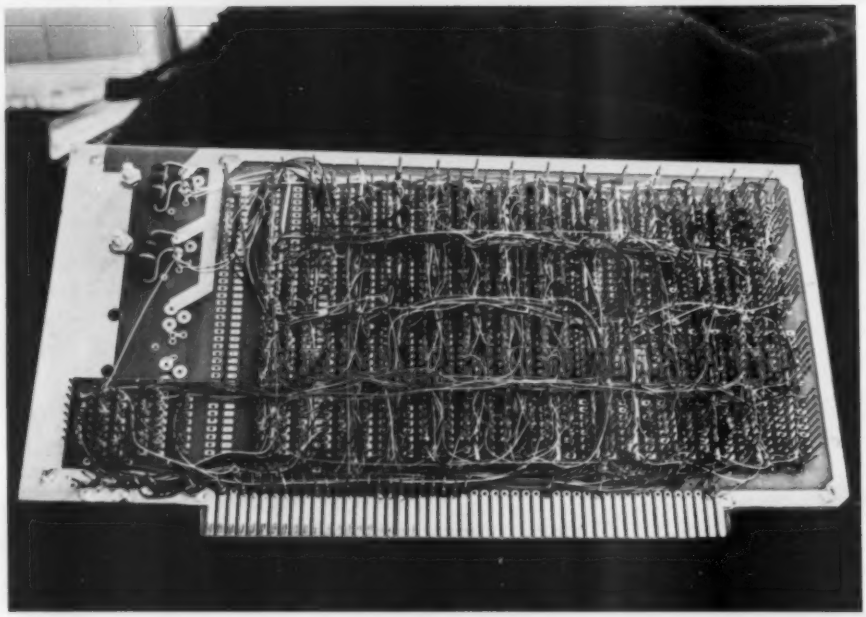


Wire-wrap side of board.

also have to be sure that I am using the correct frames of the raster to avoid producing some weird characters. It turns out that only about 482 lines of the raster are useful. The rest are contained within the field of the blanking pulses, and attempting to use them results in a rolling display or worse. Otherwise I would have stayed with 16 scan lines per character. I might also mention that the choice of 14 scan lines per character was appealing to me until I tried it and found that the lines began to be uncomfortably close together.

Display Control

Several signals within the control circuitry are important, and discussion of their functions will help to explain the operation of the display control (see Fig. 5). These are PAGE ACTIVE, FIELD INDEX (FI), LINE ADVANCE, END OF PAGE (EOP), END OF LINE (EOL), MASTER CLOCK (MC), VERTICAL DRIVE (VD), HORIZONTAL DRIVE (HD), and COMPOSITE BLANKING (CB). VERTICAL and HORIZONTAL DRIVE are really just vertical and horizontal sync, but the sync generator manufacturer labels them as drive. Any signal shown on the schematic with a bar above it (as $\overline{CB}$ or $\overline{VD}$) is the complement of the signal indicated. The signals VD, HD, CB, and FI originate from the sync generator (Fig. 6). The other signals are generated within the display control.

Sync Signals

I have used a National Semiconductor MM5320N TV camera sync generator to generate timing signals needed to produce a raster. It produces the VERTICAL DRIVE signal, which (along with its complement) is used mainly to reset various counters and flip-flops of the display control. The HORIZONTAL DRIVE output of the sync generator serves the same purpose. The FIELD INDEX output of the sync generator identifies field number 1 of the raster. It is a pulse which occurs for two clock cycles at the leading edge of the vertical blanking for field one. I will discuss the sync generator in more detail when I get to the description of that schematic (Fig. 6), and mention it here only as a prelude to describing the control circuitry.

Page Active

PAGE ACTIVE is a signal which goes high during the writing of a frame of information on the CRT. Thus, it will be low until the electron beam is in position to trace out the top scan line of the first row of characters and it will remain high until the last scan line of the last row of characters has been produced. When it is low, all video output is suppressed and the control circuit is mainly idle.

Here is the sequence of events which results in the clocking of the PAGE ACTIVE flip-flop (which in turn enables the rest of the display):

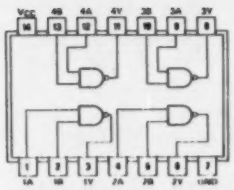
1. $\overline{VD}$ occurs (resetting other things which I will mention later) and causes the scan line counter to be loaded with a five. I will try to explain why I had to do this in a few lines.
2. The CB signal will begin clocking the scan line counter. When this counter reaches seven, the 7410 connected to the A, B, and C outputs of the scan line counter will go low, causing the PAGE ACTIVE flip-flop to be clocked, setting it high.

The reason that I load the scan line counter with a binary five is to cause a fixed number of scan lines to be ignored before clocking the PAGE ACTIVE flip-flop. Remember that I said earlier that only about 482 scan lines were useful? This is because 21 of the 262½ lines per frame occur during the vertical blanking pulse. This leaves only 241½ useful lines per frame. By using the COMPOSITE BLANKING signal to clock the scan line counter, I already ignore the first 21 lines since no clocking of the counter will occur during the vertical blanking pulse. By presetting the scan line counter to five, it will take only a couple of lines to get it to seven where it causes the PAGE ACTIVE flip-flop to come on, thereby wasting as few as possible lines. It turns out that the counter will count the vertical blanking pulse so that I am in fact only wasting about one half of a line at the top of the display. In any case, there are not many lines to waste and this method utilizes the maximum amount of useful raster.

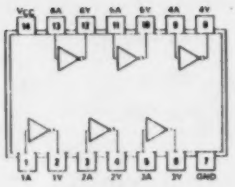
Once the PAGE ACTIVE flip-flop has been set, the row counters and the width counter are enabled (follow the logic on the schematic to convince yourself of this). The PAGE ACTIVE flip-flop is ultimately cleared by the END OF PAGE signal.

Odd/Even Flip-Flop

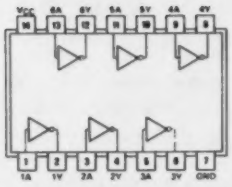
The FIELD INDEX is used to keep track of which frame is being written at any given time. Remember that I mentioned earlier the necessity to alternate even and odd scan lines of the characters being displayed. The alternation must occur between rows of characters and also between frames. The FIELD INDEX is used to control the starting point of the odd/even flip-flop within a given frame. This is accomplished by



SN5400/SN7400(J, N)



SN5404/SN7404(J, N)



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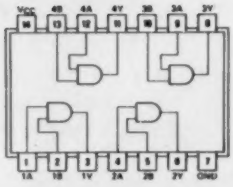

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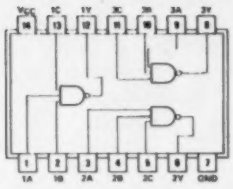
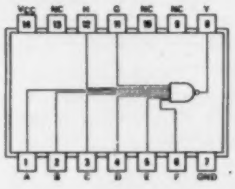
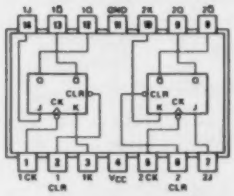


SN5410/SN7410(J, N)



SN5430/SN7430(J, N)



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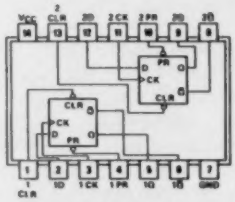

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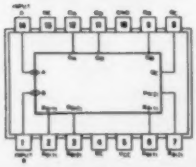
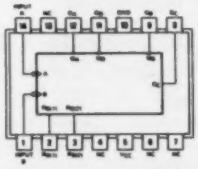
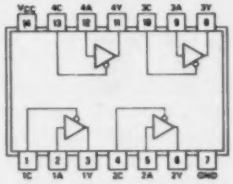


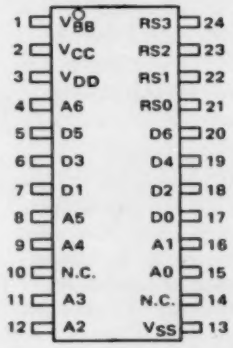
SN5490A, SN7490A



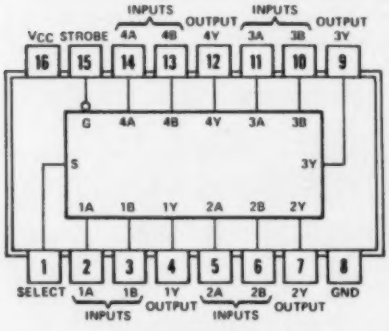
SN5493A, SN7493A



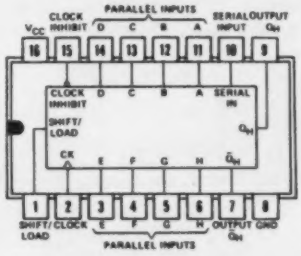
SN54125/SN74125(J, N, W)



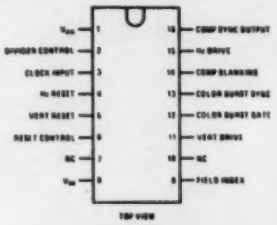
MM5320N



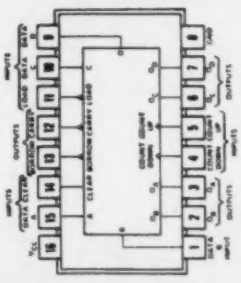
SN54157, SN74157



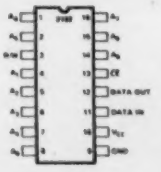
SN54165, SN74165



MCM6571A



SN54192, SN74192



2102

Fig. 3. Pin configurations for the various ICs used in the display.

setting the odd/even flip-flop with the END OF PAGE signal. The EOP flip-flop, however, is cleared by $\overline{VD}$, causing the EOP signal to go away at the beginning of the VD pulse. The FI pulse hangs around for a couple of clock cycles after the beginning of the VD pulse, so that if it (FI) is present it will clear the odd/even flip-flop. Thus the odd/even flip-flop will be set or reset at the beginning of a frame.

The output of the odd/even flip-flop serves as bit zero of the line input to the character generator, causing it to generate the appropriate dot information. The output of the odd/even flip-flop also serves to control the number of scan lines allowed for a row of characters by causing the scan line counter to divide by either seven or eight. This is relatively straightforward and I leave it to the reader to verify that this is so by examining the schematic (I always hated it when textbook writers did that to me ... now it's my turn). Upon completion of two complete scans, there will have been 15 scan lines allotted for each row of characters.

Line Advance

The LINE ADVANCE signal is the same as used to enable the PAGE ACTIVE flip-flop, except that once the PAGE ACTIVE flip-flop is set, the LINE ADVANCE will clock the row counters. I had trouble with a glitch on the LINE ADVANCE, so I had to

put in an 820 (or so) pF capacitor to get rid of it.

Row Counter

The row counter consists of a 7490 decade counter and one half of a 7473 flip-flop. The row counter provides the high order five bits of the memory address to the multiplexers.

End Of Page

The EOP flip-flop is clocked by the row counter after 32 rows of characters have been displayed in a given frame. It is used to clear the PAGE ACTIVE flip-flop (which inhibits the world) and also to set the odd/even flip-flop as described above. EOP is reset by VERTICAL DRIVE.

The Character Generator Again

The character generator accepts a row input from the scan line counter to tell it which row of a matrix to present to its output. The character code is the rest of the input to the character generator and comes directly from the memory. The seven bit output of the character generator represents part of the dot pattern of a character and is presented to the 74165 shift register. Clocking of the shift register to dump the dots out in serial fashion is by the MASTER CLOCK. Loading of the shift register is controlled by circuitry associated with the width counter.

Width Counter

The width counter is a 7490 decade counter which is really dividing by nine because of external gating (shown in the schematic). The width counter is held at zero whenever the PAGE ACTIVE line is low. It is also cleared by the COMPOSITE BLANKING to insure that it begins every line from zero.

The width counter is clocked by the MASTER CLOCK and is responsible for determining the number of clock pulses allowed for each character in a row. I have allowed nine clock pulses per character. Seven pulses are needed to display the seven dot width of a character, plus one leading and one trailing pulse to allow for spacing between. I have arranged the loading and clocking of the shift register to achieve both leading and trailing blank dots, as opposed to simply allowing two blank dots between characters. This distinction is not too important when displaying normal video, but when the video is inverted on a given character, it assures that the character will be centered in the field of white.

The D output of the width counter is used to provide a load signal to the shift register. The C output is used to clock the column counters, which count the number of characters per row. Note that the column counters are advanced *before* the shift register is loaded. This is to allow sufficient time for the two memories (the main character memory and the character generator) to stabilize. The data loaded into the shift register will be the data from the last character, because of the memory access time.

Column Counters

The column counter, a 7493 and part of a 7490, counts the number of characters within a row and provides the low order six bits of address information to the memory control board. The column counter is reset by the HORIZONTAL DRIVE pulse to insure that it begins counting at zero for each row. The C output of the width counter is used to clock the column counter as discussed above.

One half of the 7490 used in the column counter is a divide-by-four counter, while the other half is used as a flip-flop. To see this, note that the D output of the 7493 is connected to the B clock of the 7490 (the B clock is the input to the divide-by-five stage of a 7490). The C output of the 7490 is used to clock the A input, which will cause the A output to go high after the fourth time the B input is clocked. The A output is connected in turn to the J input of the END OF LINE flip-flop. The END OF LINE

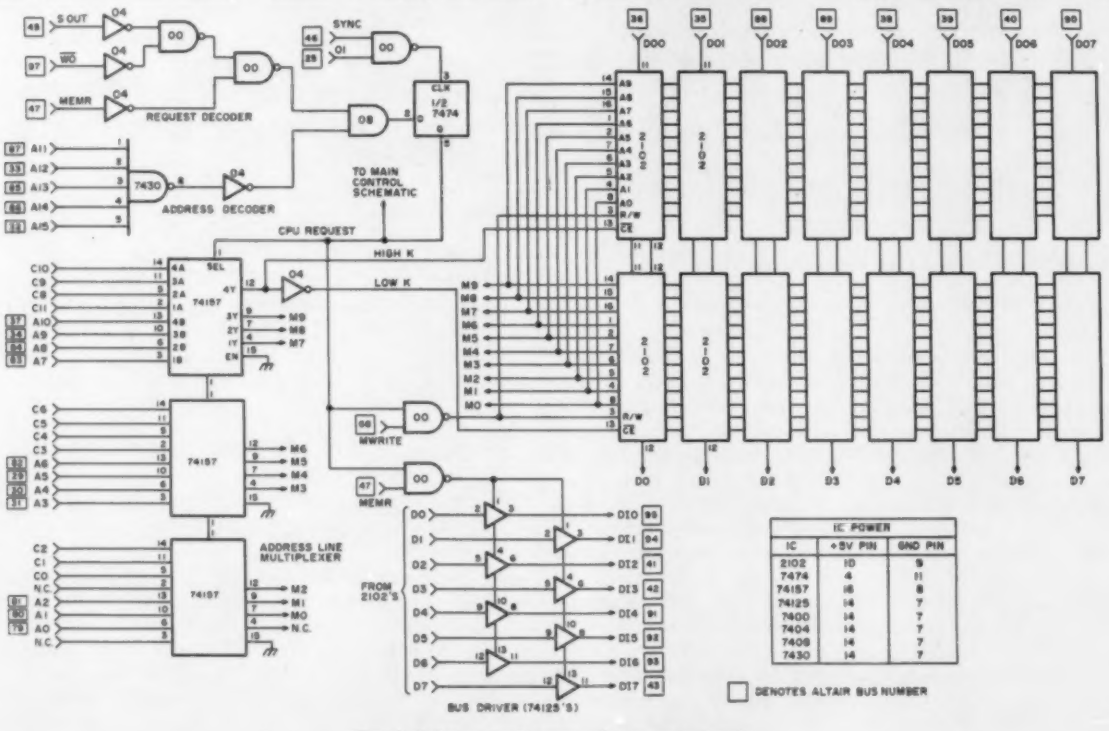
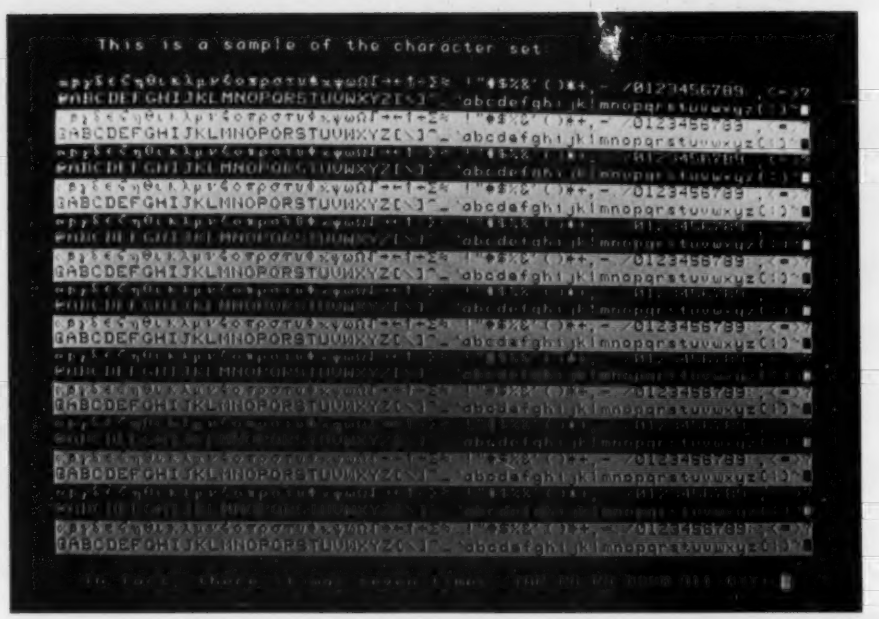


Fig. 4. Schematic diagram of memory circuits.

flip-flop will be clocked on the falling edge of the D output from the width counter. The output of the EOL flip-flop then inhibits any further loading of the shift register, hence ending the current line.

The reason for all this playing around with the column counter is to allow the last character to be loaded into the shift register. If you remember the discussion about the column counter being clocked to the next character before the data from the current character is loaded into the shift register, you will see that the column counter will be at 64 (representing the 65th character since the counters start at zero) when the load pulse for character 63 (the 64th character) occurs. Since I have to allow the 64th load pulse to occur, I came up with the above scheme to delay the clocking of the EOL flip-flop.

I might mention at this point that there is really no good reason to bother using the C output of the 7490 to clock the A input. The internal D flip-flop of the 7490 is already clocked by the C output, so the D output could serve as the J input to the flip-flop. In fact, by gating together the D output of the 7490 section of the column counter with the D output of the width counter (using a 7408 AND gate with the output of the AND gate clocking the A input of the 7490), the EOL flip-flop could be eliminated, the A output of the 7490 replacing the EOL signal. But you would have to use a NOT gate to derive $\overline{EOL}$ and then you would have one half of a flip-flop left over elsewhere. I mention this possibility partly for the benefit of anyone who might be making changes where it would be nice to have an extra flip-flop, and partly to illustrate that there is nothing sacred about the way I have done things. As long as you understand the purpose of each part of the circuit, you can modify it to suit your particular requirements or supply of parts.



Character set.

Video Inversion

The Invert Video flip-flop controls inversion of the video signal to produce a black character within a field of white. Note that by inverting the video, I am referring only to inverting the character part of the video, not the sync and blanking signals.

The video may be inverted character by character, allowing the use of multiple cursors (I use an inverted blank for a cursor) or techniques such as inverting important messages (or flashing them between normal and inverted video). The display also makes a dandy checkerboard. The eighth bit of the display memory is used to control the state of each character.

Since the memory has already been advanced to the next character during the time in which dots for a given character are being drawn by the electron beam of the CRT, it is necessary to latch the eighth bit of memory in the Invert Video flip-flop. This bit is clocked into the flip-flop at the same time the load pulse for the shift register goes high. The outputs of the flip-flop control a multiplexer made from 7400 gates, thereby selecting either the Q or $\overline{Q}$ output from the shift register. The Invert Video flip-flop is forcibly cleared after the EOL signal comes on (EOL and the D output of the width counter are gated to produce a clear pulse), to assure that the brief part of a line traced by the electron beam after the last character is blank.

Note that the output of the video inversion multiplexer (the 7400 gates) is clocked by the MASTER CLOCK. The main reason for this is to eliminate the possibility of generating a wide video pulse (the top of a "T" or an inverted blank would be examples) which would cause the trace produced by the electron beam to bloom or, at the very least, appear brighter than other parts of the display. Clocking the video makes all video pulses the same width (the top of a "T" would come out as seven consecutive short pulses rather than as one long pulse) and results in a very uniform brightness over the entire display.

Video Inhibit

The Video Inhibit flip-flop prevents generation of random video pulses which would otherwise result from decoding of wrong information by the character generator during times when the processor is using the display memory. Whenever the processor makes a request for the memory (as indicated by the CPU REQUEST signal from the memory control schematic), the Video Inhibit flip-flop is cleared. The Video Inhibit flip-flop inhibits further loading of the shift register and forces the Video Invert flip-flop to the off state the next time it is clocked. Once the processor request has been cleared, the Video Inhibit flip-flop will be clocked by the end of the next load pulse, setting it back to normal. Note that the load pulse which clocks the Video Inhibit flip-flop will be ignored by the shift register, since it does not clock the flip-flop until the trailing edge. The next load pulse will cause the shift register to be loaded. The result is that video is inhibited during pro-

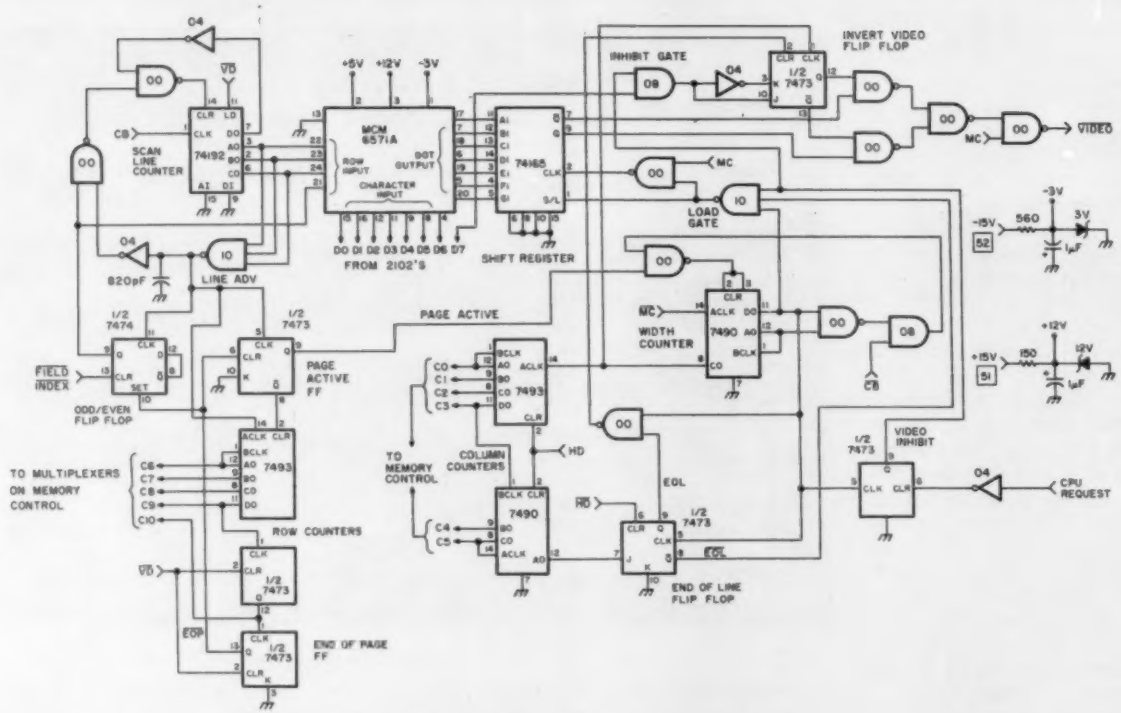


Fig. 5. Schematic diagram of display control circuits.

cessor requests for memory and for at least one complete character cycle after control is restored to the display (to assure that the memory is back in step with the display control).

The loss of a row of dots from random characters around the screen during processor requests is not a problem, since it is hard to notice the absence of a single row of dots within a single character for 1/30th of a second. The only time that the display is noticeably degraded is when the processor is making requests at a very rapid rate. But the rate is so great that it would not be possible for most people to read the display anyway.

One instance where the degradation of the display caused by cycle stealing becomes noticeable is during a line feed. The line feed (or scroll) is a software function and involves reading and rewriting almost all 2048 characters of the display. The process is very fast (50 to 100 milliseconds, depending on your software and memory cycle time) and results in a noticeable display degradation because of the large number of requests within a short time. But the degradation during a line feed is not a problem since the display would be non-readable during a line feed even if it was not degraded. Also, it happens so fast that one does not really perceive the display to have lost anything unless he is really looking for it.

One other thing to remember (to prevent heart seizure the first time it happens) is that if you stop the processor and examine the contents of a location within the display memory, then you are in effect requesting 100 percent of the memory's time, resulting in a completely blank display.

Sync Generator and Video Combiner

The sync generator schematic includes the MASTER CLOCK and the video combiner. The MASTER CLOCK is a simple oscillator made from 7404 gates, a few Rs and Cs, and a 12.6 MHz crystal.

The National Semiconductor MM5320 sync generator requires a 1.26 MHz clock, so I divided, the 12.6 frequency by ten. Note that the 7490 is used as a symmetrical divide-by-ten counter by going through the divide-by-five stage and then into the divide-by-two stage.

I have buffered all outputs of the 5320 except the FIELD INDEX output, which is only connected to one gate anyway. As I discussed earlier, the sync generator does all the timing necessary to generate the appropriate sync and blanking signals to produce a raster.

Putting the COMPOSITE SYNC, COMPOSITE BLANKING, and VIDEO (from the display control schematic) to form a single video signal is the function of the video combiner. The video combiner is built from 7406 open collector inverters and some diodes. The resistors shown at the junction of each of the 7406 outputs and its respective diode determine the weight of the given signal. The resistors I have shown are not too critical and may be changed for best results. The resistor for the blanking component is chosen to produce about a .2 to .3 volt change in the output level when the blanking turns on and off. Similarly, the sync component should be around .7 volts and the video component should be a couple of volts (or whatever produces good contrast). These values seem to work well with the monitor I use, as it has a 75 Ohm input impedance.

The video monitor shown in the photographs is a Motorola M2000-1SC. It is a good quality nine inch monitor having a bandwidth of about 12 MHz. If you plan to use an old black and white TV, you may experience problems with overscan (which is built into most TV sets to make the picture look bigger) or bandwidth. The Motorola monitor costs around $115, but is well worth it for this application.

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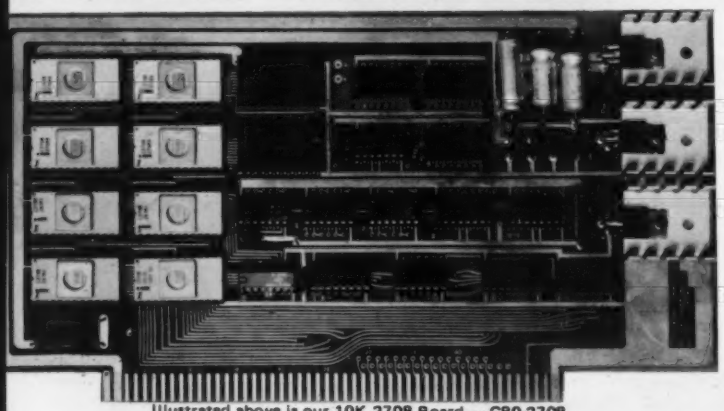

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0156 589 WB1T 0157 599 OH 0158
This is the portion of the screen which I use for displaying text received from other stations when I operate radioteletype. The line immediately above this area is the log line which is used to display information about a contact. In this example the information is that required for the BARTG RTTY contest, my time and RST, the station worked, his time, RST, and section. The operating program that I use enters the log information into the log line automatically.
I am able to scroll this (or any) portion of the screen independently of the rest of the screen.
/3CQ ---This is the command line.
This portion of the screen is used as a buffer/display for all text to be transmitted. Anything I type (except for special commands) is entered into this area by special editting routines which allow for ease of correction. Special commands are recognzed by the program and are displayed in the command line. The command shown above caused three lines of "CQ" to be generated. Other commands control generation of other standard texts, the sending of calls and exchange information and the operation of the station. The inverted character shown part way through the CQ shows the current location of the transmitter in the buffer.
CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ DE WA8VMP WA8VMP WA8VMP
CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ DE WA8VMP WA8VMP WA8VMP
CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ DE WA8VMP WA8VMP WA8VMP
WA8VMP WA8VMP WA8VMP DON IN COLUMBUS, OHIO K K K

Radioteletype contest program example (note multiple cursors).

require a good five volt supply. I used two 7805 regulators (the same as used by MITS and other Altair board manufacturers) to regulate power from the Altair bus. I use one for powering the memory and one for the logic. Be sure to install plenty of .1 uF capacitors at various points on the board, to prevent noise problems from messing up the display. If you are building the display for use outside an Altair type computer, I will assume that you can also manage the power supply.

Various other voltages required by the sync generator and character generator are provided by the zener diode regulators shown on the schematics. The amounts of current needed at these voltages are very small.

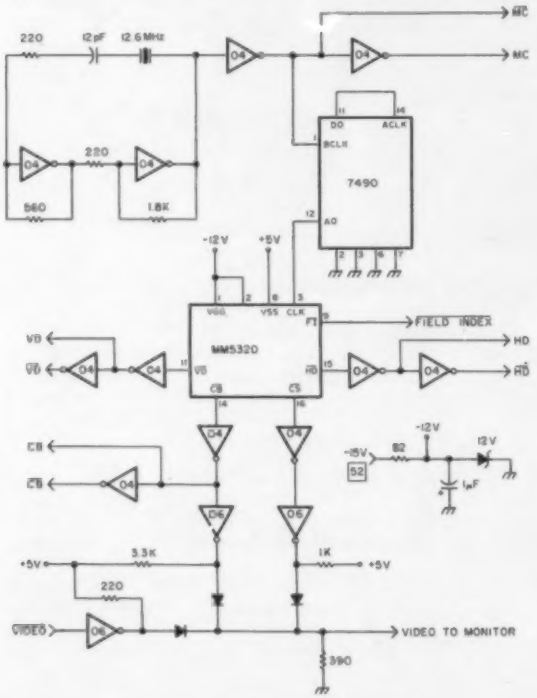

Fig. 6. Sync generator, video combiner, and clock circuits schematic diagram.

Use of the Display

The various pictures of the display show several ways for utilizing the display. I will let you read the captions rather than repeat them here, and will try instead to present a few simple ideas to get you started.

The first thing is to think of the display as a window to memory rather than as an output device. Any manipulation of data on the display (writing, erasing, updating, scrolling) involves a software process to put the desired information into the right location within the memory. There is no line feed function, nor are there any cursor positioning functions. Characters are simply stored at the correct locations. Cursors, if used, are simulated by appropriate software for the benefit of the person looking at the display. This allows the display to be configured any way you see fit. Some of the photographs depict displays where my Altair was being used as a terminal to a DEC PDP-10. A simple program was written which made the display behave as though it were a Hazeltine 2000 video terminal. But if you read the text in the picture of my radioteletype application, you will see that the display is being used in a way few, if any, other displays or terminals could duplicate.

Some specific methods to accomplish normal functions are:

1. ERASING – Simply store blanks throughout the display memory. Note that selective erasing is just as easy.
2. SCROLLING – Read a character from the second line and write it back in the same location on the first line (i.e., move it back 64 places). Continue reading and writing characters until you have rewritten the last line into the second to last line. Then erase the last line. Note that it is a simple matter to scroll only a part of the display instead of all of it.

Construction Ideas

Before you begin building the display, you should make copies of the schematic and make any changes you think necessary to adapt the display to your system. Then assign numbers (or letters) to all of the ICs and number the pins. If the IC numbering scheme is devised to represent a socket coordinate, you will have less trouble when you begin to wire-wrap the board. Then make all power and ground connections. Then finish the

Example of split screen capability.

board by making all wraps associated with a node on the schematic at the same time, indicating (by small colored slashes or otherwise) that you have completed a node.

Testing

There is very little I can mention here, as there are so many things that can be wrong from a misplaced wire-wrap. I suggest checking the sync generator to be sure it is working and then proceeding to the various counters and flip-flops to see which are working. The memory may be tested for proper operation by writing a memory diagnostic program. Obviously, for any real trouble-shooting or debugging you will need an oscilloscope – and you will need to be able to think through the operation of the display. Beyond this, I think I would be writing in vain except for saying, "Good luck!" ■

```
2000 DB FC          0010 TST IN 252
2002 E6 80          0020  ANI 80H
2004 CA 00 20       0030  JZ TST
2007 DB FD          0040  IN 253
2009 FE FF          0050  CPI 0FFH
200B CA 3D 20       0060  JZ ERASE
200E FE 0A          0070  CPI 0AH
2010 CA 51 20       0080  JZ LF
2013 FE 8A          0090  CPI 8AH
2015 CA 5F 20       0100  JZ UPLF
2018 FE 7F          0110  CPI 7FH
201A CA 76 20       0120  JZ DEL
201D FE 08          0130  CPI 08H
201F CA 7D 20       0140  JZ BKSP
2022 FE 09          0150  CPI 09H
2024 CA 84 20       0160  JZ TAB
2027 FE 83          0170  CPI 83H
2029 CA 0C 10       0180  JZ 100CH
202C FE 03          0190  CPI 03
202E CA 91 20       0200  JZ CC
2031 77     20      0200  JZ CC
2031 77             0210  MOV M,A
2032 23             0220  INX H
2033 7E             0230 CURSOR MOV A,M
2034 32 9B 20       0240  STA LAST
2037 F6 80          0250  ORI 80H
2039 77             0260  MOV M,A
203A C3 00 20       0270  JMP TST
```


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*EGG – Encephalo-Gratification Generator

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OKLAHOMA CITY, OK 73116

New Products

from page 27

repeater operation will stretch below 146 MHz. The FCC's intent to deregulate is clear with Docket 21033, and if it does become law, operating requirements for 2m FM will radically change.

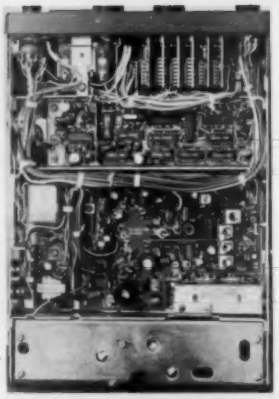
It will be necessary for 2m FM rigs to cover the *entire* band, not just the current repeater segments. Squelch systems employing continuous tone, tone burst, and the variations that go with them will become essential for accessing repeaters and repeater links. It may not be long before repeaters will have multiple links: 2 to 20m, 2 to 40m, and so on. The dream of driving across town working Europe or Australia via a 2m to 20m link might not be a dream much longer. (Wayne Green did it years ago here in Peterborough before the FCC outlawed it.)

One 2m FM rig capable of handling the new repeater revolution *now* is the Kenwood TR-7400A. It covers the entire 2m band and offers one of the most flexible squelch systems going — continuous tone-coded squelch (encode and decode or encode only with common frequency active filters), tone burst, and normal carrier squelch. The TR-7400A is delivered set up for normal carrier operation, with a series of optional modules available for the other squelch modes. A front panel selector switch allows for all three variations with an LED indicator to remind you when the TR-7400A is in the continuous (encode and decode) tone-coded mode. Kenwood has tried to eliminate the characteristic time lag in tone squelch circuits through the use of an active filter. Other squelch modes selected from the same control include tone burst and subaudible (encode only) tone. In all, Kenwood offers 25 different modules covering the tone squelch and tone burst modes. Only one frequency of each type can be used at a time, but the use of computer type connectors would allow easy modification for outboard selection of several different frequencies.

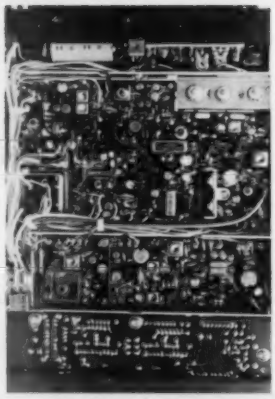
Back to that price war I mentioned earlier. Kenwood had originally announced the TR-7400A in the $450 to $550 price class. Considering its features (PLL synthesized, 25 Watts, full 2m coverage, digital readout), that sounds about right . . . right? Wrong! When the units began to trickle into dealers just after Christmas, the price tag was down to $399 and the war was on.

It's not hard to understand why Kenwood is finding it hard to keep up with demand. The TR-7400A offers you a lot for your money. Aside from the unique squelch design and full coverage synthesizer, Kenwood decided to go beyond the normal 10 Watt output of most transceivers. Despite published specifications of 25 Watts out, the TR-7400A delivered more than 30 Watts into a 5/8 wave antenna, and the low power position yielded 5 Watts out. I was easily able to adjust low power up to ten Watts and drive my 10 by 70 Watt amplifier (a necessity in the low lands up here). In most cases, I found the 25 Watt position more than adequate to access repeaters I couldn't use with 10 Watt rigs, but it was real nice to have three levels of power to choose from. Kenwood uses the Motorola MRF-208 as a driver, and the 2N6083 for the final, which may explain the massive Motorola-like heat sink. The finals are protected by *reducing* output when faced with impedance mismatches, instead of shutting down the radio completely. The front panel meter reads output, so just operating the Kenwood will tell you something about your antenna system. According to the manual, a reading of 8 in the high power mode on a scale of 10 indicates an swr of less than 1.5:1. Low power, factory adjusted for 5 Watts, reads a 3 on the meter scale. Tests with antennas purposely put out of tune reduced high power output to as low as 5 on the meter without excessive heat or transmitter shutdown.

Audio reports were good, with many stations responding that the Kenwood's talk power exceeded everything else on frequency. A deviation meter showed plenty of audio to spare; the 5 kHz spec proved to be quite conservative for my voice characteristics, and the mike gain had to be adjusted. Quality-wise, the Kenwood's audio drew compliments, although several other TR-7400A users objected to the factory supplied dynamic microphone, claiming it was too small for comfortable operation. It took a bit of getting used to, but the palm-size mike actually became preferable after a period of time. (Other large microphones were tried, but reports did not indicate any change in the audio level or quality.) Hooking up a touchtone pad couldn't be easier, since Kenwood included side panel jacks (mini type) for pad input and external speaker output, thus eliminating the need for hard to connect octal type sockets. (Ever tried to put your radio in the car at night and line up those darn pins without bending them?)



TR-7400A, top view. The shielded compartment houses the final amp.



The TR-7400A, bottom cover removed. Squelch modules go into computer connector near the ceramic filter.

The TR-7400A synthesizer is the phase locked loop (PLL) type, with LEDs for digital readout. The PLL divides the 4 MHz bandwidth into 400 channels every 10 kHz, with a push-button 5 kHz offset. Two frequency selector switches allow 100 kHz and 10 kHz switching respectively, with a four position switch for choosing band segments. A three position switch sets transmitter offset at 600 kHz up or down, plus simplex. A dual concentric volume-squelch control completes the package.

One way to measure a mobile radio's quality is what happens when the lights go out . . . can you use it in the dark? Or do you have to pack a flashlight to find out what frequency you're on? Not with the Kenwood. *Every* switchable function, from the synthesizer to the various squelch modes, has its own LED indicator. Six bright red 1" high LEDs tell you what frequency you're on, another LED indicates when you're transmitting, while still another warns that the synthesizer PLL has unlocked and the radio has automatically shut down. The TR-7400A even indicates what transmitter offset you're using, with an LED showing red for -600 kHz, green for +600 kHz, and no indication when in the simplex mode. What all this means is that the Kenwood makes after dark mobiling a snap — no fumbling, no confusion to take your attention off the highway. After a few hours of operating the radio, it only takes a quick glance to see what frequency you're on, what offset you're using, and which squelch mode is engaged. During daylight operations, you won't have to squint to read the LEDs; all controls are well calibrated independent of the LEDs and are easy to find by touch. Counting from one repeater pair to another is made simpler by Kenwood's use of stops on the frequency selector controls, allowing you to only go once around before being forced to reverse direction.

As previously mentioned in these pages, my car suffers from a bad case of ignition noise. I've tried a number of "cures" with mixed results, and have come to accept that weak signals will have to be passed by until warmer weather allows a new assault on the MGB. Kenwood included a well-bypassed power input and it seems to work; my ignition noise is clearly lower with the TR-7400A than previous 2m rigs I've had in the MGB.

You may be wondering by now . . . what about the receiver? A glance at Kenwood's specifications on the TR-7400A shows impressive figures: more than 0.4 uV sensitivity for 20 dB quieting, image rejection of more than 70 dB, and spurious interference down more than 60 dB. The radio's performance certainly backs those claims, with trips into Boston, Hartford, and New York revealing no problems with desense and intermod. The sensitivity, compared to other current rigs, is highly competitive. Kenwood uses a double conversion superheterodyne with a 10.7 MHz 1st i-f, and a 455 kHz 2nd i-f. Large helical resonators, a 10.7 MHz monolithic crystal filter, and a MOSFET front end are also used.

In the mobile, the sensitivity and noise filtering add up to a surprising combination: strong, clear signals whether the strength is S1 or against the pin. There's plenty of audio on receive, more than enough to drive a good size remote speaker . . . or the one Kenwood built in. And unlike many squelch circuits I've used lately,

Kenwood's new TR-7400A 2m transceiver.

dynamic range was outstanding, allowing me to squelch out unwanted repeaters that other radios received with the squelch fully engaged.

The TR-7400A comes complete with mounting bracket, microphone, and power cable. The mount is unique, with guide slots on both sides of the radio, and clamp snaps to secure it. Hasplike protrusions extend from the sides of the radio, allowing you to padlock the rig into the car if desired. Most users will probably choose to take the TR-7400A with them, and the bracket makes for easy removal. The device includes an angle adjustment, allowing for tilting the radio in accordance with your dashboard. By some standards the Kenwood is large, measuring just over 7 inches wide by 3 inches high and just over a foot deep. It weighs about 6 pounds, but I had no trouble mounting it in my small sports car (as the photograph indicates) and did not find its size or weight objectionable. To the contrary, the TR-7400A is a high quality radio in the best Kenwood tradition (a tradition established by the TS-520 and reinforced by the TS-820). At a price under $400 it would be less than honest to deny Kenwood's new 2m radio is one heck of a deal . . . in fact, it's a steal!! *Trio-Kenwood Communications, Inc., 116 East Alondra Blvd., Gardena CA 90248.*

Warren Elly WA1GUD
Associate Editor

HEATHKIT HD-1982 MICODER™

The process of using repeater autopatch facilities while mobile has always been a frustrating experience. Between holding in the mike button, grappling for the tone pad, and attempting to continue to drive the car, it often seems like at least three hands are needed.

The Heath Company has vastly simplified the situation through the introduction of their HD-1982 Micoder. At first glance, the unit looks like a standard microphone, but the surprise comes in turning it over. Built into the back is a miniature tone pad. Suddenly, making a call from the ol' buggy is a much easier process.

The Micoder is an easy one evening kit. Although assembly is not too difficult, it does require a steady hand and a light touch since the parts are crowded together on a rather small circuit board. The circuit consists of four ICs, a few resistors and capacitors, and an LED. By the time you add the microphone element, 9 volt battery, and tone pad, you end up with a packed case, giving you a handful that's just a hair larger than most mikes.

The circuit is simple and straightforward. The tones are generated by two NE555 timers, one for high tones, one for low. The pad itself is a miniature tactile type that makes it easy to be sure that you actually hit the button. Another little extra is an LED above the pad that tells you that a tone has been generated. Warning . . . be *very* careful when bending the LED to fit it into the circuit board. I broke two of them.

The microphone itself has not been skimped on. In fact, this high impedance capacitor type with built-in audio amplifier is better than standard mikes supplied with many rigs. When the pad is being used, the mike is automatically disconnected from the output circuit.

Heathkit's HD-1982 Micoder.

After construction, one of two methods can be used for alignment. By far the easiest is the use of a frequency counter. Two miniature pots are used to set the high and the low tones, a process that only takes a couple of minutes.

For those without access to a counter, method two is a little more complicated. It requires access to a repeater site receiver with tone decoding circuits. In that way, tones are set by trial and error.

The Micoder worked famously the first time it was hooked up. I ran into no problems accessing and using the autopatch of the Keene NH repeater. Reports of crisp audio were received. Best of all, I was able to drive safely while punching up the number.

The Micoder can be mated to just about any transceiver on the market with a low impedance input. It worked well with several rigs owned by *73* staffers.

In our age of increased miniaturization and utility, the Micoder continues with the trend of smaller, lighter, and easier to use mobile equipment. The price of $49.95 is quickly repaid in both safety and convenience. *Heath Company, Benton Harbor MI 49022.*

Stan Miastkowski WA1UMV
Associate Editor

HAM RADIO CENTER'S HAM KEYS

With the granting of Novice privileges to Technician class licensees, the Novice bands have become considerably busier. Manufacturers are doing a booming business in high band transceivers and related accessories, including keys.

The Ham Radio Center in St. Louis MO manufactures a line of keys that are called, interestingly enough, the Ham Keys. There are two basic models, the HK-1 and the HK-3. The HK-1 is a dual lever squeeze paddle designed for use with any electronic keyer. The paddles are easily adjustable for personal preference of contact spacing and can be reversed for wide or close finger spacing. The HK-3 is the old standard straight key. This deluxe model is a smooth performer and worked extremely well at the close contact spacing that I like to use.

Both the HK-1 and the HK-3 are mounted on heavy cast iron bases with rubber feet that keep them solidly planted without the need for attaching them to a table or an ugly piece of board.

Variations on the same theme are provided by the model HK-2, which is simply the squeeze key without a base, and the HK-4, which has both the straight key and squeeze model mounted together on a large heavy base.

The Ham Radio Center also markets the Ham Keyer, the model HK-5 electronic keyer. This little unit features an iambic circuit for squeeze keying, self-completing dots and dashes, and dot memory. It can be operated by the built-in battery or external power, has built-in sidetone, and can be used for grid-block or direct keying.

Unlike many other manufacturers, the Ham Radio Center doesn't have a bewildering array of similar models. The Ham Keys and Ham Keyer are simple and solidly built, an investment that should last for years. *Ham Radio Center, Inc., 8340-42 Olive Blvd., St. Louis MO 63132.*

Stan Miastkowski WA1UMV
Associate Editor

NATIONAL SEMICONDUCTOR TO MARKET DIGITAL CLOCK MODULE FOR AUTOMOTIVE, AVIATION, AND MARINE USES

A new 12 volt dc digital clock module intended primarily for automotive applications has been added to National Semiconductor's line of digital timekeeping modules.

According to module products marketing manager Jerry Zis, the clock module, which is fully protected against automotive transients and battery reversal conditions, is ideal for use in manufacturer-supplied car dashboard clocks, after-market clocks for autos and recreational vehicles, in aircraft and marine clocks, and in 12 volt dc and portable and battery-powered instruments.

Known as the model MA1003, the module is a complete digital clock for all 12 V dc uses. It employs National's model MM5377 monolithic MOS-LSI clock circuit, along with a 4 digit 0.3 inch green fluorescent display, a 2.097 MHz crystal, and supporting components.

"The new module joins National's existing line of digital clock modules for clock radios, alarm clocks, and instrument panels," Mr. Zis said. "With the MA1003, all you need are a few switches and a lens to have a complete ready-to-use automotive clock."

The device features low standby power consumption, an internal crystal timebase, and an automatic display brightness control logic that blanks the display when ignition is off and reduces brightness to one-third when park or headlamps are in use, also following the dash lamp dimming control setting.

Timing accuracy is excellent, typically within one-half second per day, or only a quarter of a minute per month. The display features leading zero blanking and has a blinking colon activity indicator. Display color is filterable to blue, blue-green, green, or

Ham Radio Center's HK-4. Note the heavy cast iron base.

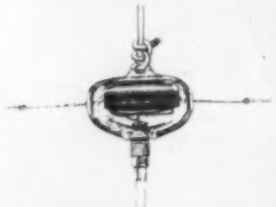
The National Semiconductor digital clock module.

yellow shades. In order to prevent tampering, the hours-advance and minutes-advance switches are disabled when the display is blanked. With ignition or lights off, the display turns off but can be activated by closing a switch. This feature minimizes power consumption in portable applications. A built-in 6 pin edge connector allows easy interconnection to the module.

The MA1003 12 V dc automotive clock module, priced at $25 in lots of 100, is available from stock through National Semiconductor Corporation and its franchised distributors. *National Semiconductor Corporation, 2900 Semiconductor Drive, Santa Clara CA 95051.*

GREENE INSULATOR AIR WOUND TRANSFORMER

Greene Insulator has introduced a new air wound transformer that doubles as the center feedpoint for wire antennas. This device is destined to replace the old egg insulator/taped coax mess that usually adorns the feedpoint of amateur dipoles and inverted "V" antennas. The transformer, which is air wound with #14 wire, not only provides a 1:1 impedance match between antenna and 52 Ohm coaxial cable, but also serves as the "start point" for any wire antenna. The Greene transformer is constructed of high impact polystyrene, and is virtually indestructible. The face of the 4" x 3" "egg" is clear, allowing the user to see the coil inside. An eyelet is moulded into the top for easy antenna support (handy for inverted "V"s), and the coil is terminated with a standard PL-259 connector, complete with waterproof gasket. It is impossible for this device to leak. The ends of the coil extend about two inches from each end of the transformer, and consist of hard drawn #12 copper wire with hooks at the end, ready to be soldered to the antenna sections.



The Greene 1.7 to 30 MHz impedance transformer.

In actual use, the transformer worked well. The device was tested with a long wire inverted "V" beam on twenty meters, and no tune-up or operating problems were observed. One operator indicated that the receiver noise level was lower when using the antenna with the Greene transformer, as compared to one with an unbalanced coax feed arrangement. Possibly this was due to decreased outer shield pickup in the antenna system using the Greene transformer, which allows the dipole to be correctly driven as a balanced device. By any standards, the Greene air wound transformer performed exactly as advertised, and no problems were encountered. *Greene Insulator, W1-CPI, 3 Pilgrim Drive, Bedford NH 03102.*

John Molnar WB2ZCF
73 Magazine Staff

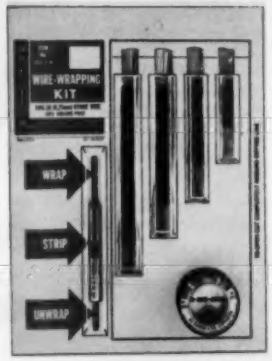
THE SYSTEM 4000

A computer system designed specifically for the ham operator has finally been developed. Curtis Electro Devices, Inc., has introduced their SYSTEM 4000, a turn-key minicomputer consisting of CPU, keyboard, 1K of RAM, input and output ports, and TTY serial interface. The system also has provision for up to 8K of ham applications programs, which are contained on PROM. The self-contained system also has provision for accepting four additional PC cards, compatible with the popular Altair bus.

The system presently supports the following programs: an automatic Morse code reader (6-300 wpm), a software paddle keyer, a keyboard keyer with 200 character buffer, and a full or half-duplex ASCII terminal. The monitor device, a TVT or Teletype, is not included with the basic computer. General programs such as an 8K BASIC are also available.

A general ham applications module is also available for those already owning a computer capable of supporting the Altair bus system. This module supports the features of the SYSTEM 4000, and is called the HAM-S100.

The devices are available from



OK Tool's new Wire-Wrapping Kit.

Curtis Electro Devices, Inc., Box 4090, Mountain View CA 94040, (415) 964-3136.

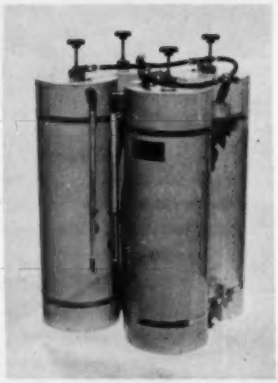
OK TOOL WIRE-WRAPPING KIT

OK Tool's new Wire-Wrapping Kit features selected items of particular value to the prototype engineer and hobbyist alike. It includes a unique new wire-wrapping tool, a roll of wire-wrapping wire, and pre-stripped wire in 4 popular lengths.

The tool, Model WSU-30, is a combination tool that wraps *and* unwraps 30 AWG (0, 25mm) wire on .025 (0, 63mm) square pins, *plus* strips 30 AWG wire using handy built-in stripper. The wire is top quality Kynar® (Pennwalt) insulated silver-plated copper. Supplied in the kit are a 50 ft. (15m) roll plus pre-cut and stripped wire in insulated lengths from 1-4 inches (25-100mm) stripped 1 inch (25mm) on each end. Available with blue wire as Model WK-2B, white wire as WK-2W, yellow wire as WK-2Y, and red wire as WK-2R. Conveniently packaged and available for immediate delivery from *OK Machine and Tool Corporation, 3455 Conner Street, Bronx NY 10475.*

BpBr CIRCUIT DUPLEXERS

Wacom Products, Inc., of Waco TX has announced a new line of duplexers which include the use of a new exclusive circuit developed by the company. When used with a high Q filter, the "BpBr Circuit" provides superior



Wacom's Model WP-641.

suppression of spurious and sideband noise between and adjacent to the duplex frequencies, particularly when the duplex frequencies are close spaced. A patent is pending on the new circuit.

Model WP-641 consists of four 8" OD cavities with the BpBr Circuit and is designed for use with duplex stations in the 144-174 MHz band when the Tx to Rx frequency separation is 500 kHz or more. It provides bandpass characteristics near the pass frequencies and band-reject cavity characteristics at the frequencies to be attenuated. Superior Tx to Rx isolation is a feature of the new model.

For additional information contact *Wacom Products, Inc., P.O. Box 7307, Waco TX 76710.*

YAESU SERVICE MANUAL AVAILABLE FOR FT-101 SERIES

A 200 page technical service manual, written in layman terms, covering the various models of the FT-101 series transceivers, is available from Yaesu Electronics Corporation of Paramount, Calif., and their dealers throughout the United States.

Available in February, 1977, it is priced at $25.00 U.S. dollars, F.O.B. Paramount. Send orders to (or you may contact their U.S. dealer organization): *Yaesu Electronics Corporation, P.O. Box 498, 15954 Downey Avenue, Paramount CA 90723.*

The Curtis SYSTEM 4000, a computer designed specifically for the ham.

4 HOT SPECIALS

1. MULTI-CONDUCTOR WIRE

20 conductor (#28 stranded wire)	20 ft/$5.95
26 conductor (#28 stranded wire)	20 ft/$7.50
28 conductor (#24 stranded wire)	20 ft/$9.95
34 conductor (#28 stranded wire)	20 ft/$9.95

We have a limited quantity of high quality, multiconductor flat cable. Unfortunately we couldn't get as much as we wanted, so if you're interested, get your order in soon. Subject to prior sale.

2 HAM SPECIAL: TRIMMER CAPS

10/$1.95 ASSORTED VALUES. We picked up a batch of brand new, American made, trimmer caps in assorted styles and values. House numbered, so we're not sure of the exact values---and until we get them all tested out, we're selling assortments at a super bargain. Lowest value caps go from 2-8 pF; highest value caps from 50-60 pF. Ltd qty.

3. TEFLON HOOKUP WIRE

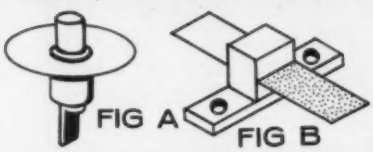
250 FT.... $2.95....LTD QTY

TEFLON INSULATION DOESN'T MELT UNDER NORMAL SOLDERING HEAT. BESIDES, THIS IS HI-FLEXIBILITY, TOP QUALITY STRANDED HOOKUP WIRE---THE COMBINATION IS UNBEATABLE. SORRY, NO CHOICE OF COLOR.

4 .8" (!) digit Clock Display

$4.95 EACH; 3/$12.50 DON'T CONFUSE THIS WITH THE .5" TYPES OFFERED BY OTHERS. THESE DIGITS ARE **BIG!** AM/PM INDICATOR, COLON, AND 3½ DIGITS WRAPPED IN A CLEAR RED PLASTIC ENCLOSURE. COMMON CATHODE. **LIMITED QTY.**

RF POWER TRANSISTORS



For operation at lower frequencies gain and efficiency are higher, giving higher output power.

PRICE	FIG.	Pd MAX @ 25°C	Pout MIN @ 2 GHz	PIN	EFFICIENCY @ 2.0 GHz	
$4.95	A	3.5W	1.0W	310mW	30%	sim RCA 2N5470
$5.95	B	8.7W	2.5W	300mW	33%	sim RCA TA8407
$6.95	B	21W	5.5W	1.25W	33%	sim RCA 2N6269
$7.95	B	29W	7.5W	1.5W	33%	factory select part--2N6269

Terminal Strips 30/$2

Just before this ad went to 73, we managed to get a great deal on terminal strips. These are both 6 and 7 lug types, with the center terminal connected to the ground lug. At this price there's no choice of type, but we didn't think you'd mind...now's a fine time to pick up an assortment of these oft-used pieces of electronic hardware. (Note: in most assortments the number of 7 lug strips is greater than the number of 6 lug strips).

$14.99

- *6 DC Volt ranges
- *3 DC current
- *5 AC RMS ranges
- *2 ohms ranges
- *-20 to +22 dB
- *Includes 34" test leads
- *20KΩ/V DC
- *10KΩ/V AC
- *50 uA meter
- *Ohms adjust
- *5¼" x 3¼" x 1 5/8"

Requires 1 "AA" cell (not included). Please add $1 for shipping and handling.

New 12V 8A* supply

$39.95

---PLUS POSTAGE---

*12 AMPS WITH 50% DUTY CYCLE

Easier to build---all parts except xfrmr, bridge, and filter caps mount on the PC board. Overvoltage protection, RF bypassing, chunky transformer, backed by years of experience in the design of powerful supplies. Our latest is our greatest...we're sure you'll like it.

GODBOUT

BILL GODBOUT ELECTRONICS
BOX 2355, OAKLAND AIRPORT, CA 94614

TERMS: Add 50¢ orders under $10; over $10 add 5%. No COD. Cal res add tax. Mastercharge® and Bank-Americard® orders: call 415-562-0636, 24 hrs.

74 LS TTL

1/5 THE POWER OF TTL BUT NO SPEED PENALTY

00	$0.36	22	$0.38	124	$2.50	168	$1.87
01	0.36	27	0.38	132	1.50	169	1.87
02	0.36	30	0.36	138	1.38	175	1.35
04	0.42	32	0.38	139	1.38	221	1.38
08	0.38	37	0.53	155	1.38	258	1.38
10	0.36	38	0.53	157	1.25	273	2.25
11	0.38	42	1.25	160	1.85	367	1.00
20	0.36	74	0.56	162	1.85	368	1.00
21	0.38	75	0.85	163	1.85	377	1.88

JUST IN! 74LS14.....$1.38

LINEARS

T=TO-220 POWER PACKAGE K=TO-3 POWER PACKAGE
TK=TO-66 POWER PACKAGE H=HERMETIC TO-99
M=MINIDIP D=DIP

301H,M	OP AMP	.39
304H	NEGATIVE VOLTAGE REGULATOR	.75
305H	POSITIVE VOLTAGE REGULATOR	.75
307H	OP AMP	.35
308M	OP AMP	1.00
309H	+5 VOLT REGULATOR	1.00
309K	+5 VOLT, 1A REGULATOR	1.25
311M	VOLTAGE COMPARATOR	1.00
311H	VOLTAGE COMPARATOR	1.00
316H	HI INPUT Z OP AMP	2.50
318H	FAST OP AMP	1.00
320/12T	-12 VOLT, HALF AMP REG.	1.25
339D	QUAD COMPARATOR	1.50
340/5K	+5V 1A REGULATOR	1.25
340/5T	+5V 1A REGULATOR	1.75
340/6T	+6V 1A REGULATOR	1.75
340/8K	+8V 1A REGULATOR	1.75
340/8T	+8V 1A REGULATOR	1.75
340/12T	+12V 1A REGULATOR	1.75
340/15K	+15V 1A REGULATOR	1.85
340/15T	+15V 1A REGULATOR	1.75
340/18K	+18V 1A REGULATOR	1.75
340/24K	+24V 1A REGULATOR	1.75
340/24T	+24V 1A REGULATOR	1.75
373D	AM/FM/SSB IF DETECTOR	1.95
377D	DUAL 2 WATT AUDIO AMPLIFIER	2.50
380M	MINIDIP 380	.95
380D	2W AUDIO AMP	1.45
381D	DUAL LO NOISE PREAMP	1.65
382D	STEREO LO NOISE PREAMP	1.65
531M	HI-SLEW OP AMP	1.25
540H	AUDIO POWER DRIVER	1.95
555M	TIMER	.60
565D	PHASE LOCKED LOOP	1.25
566M	VCO/TRIANGLE SQUARE OUT	2.10
567M	TONE DECODER/PLL	2.50
723D	PRECISION REGULATOR 150 MA	.50
723H	PRECISION REGULATOR 150 MA	.60
725H	INSTRUMENTATION OP AMP	2.00
733H	VIDEO AMP	1.50
741M	OP AMP	.30
741H	OP AMP	.35
747D	DUAL 741 OP ANP	.50
748H,M	OP AMP	.35
1458	SEE 5558M	
1496D	BALANCED MODULATOR/DEMOD	1.25
1556H,M	PREMIUM OP AMP	1.00
1558	SEE 5558M	
1596	SEE 1496D	
3026H	TRANSISTOR ARRAY	1.25
3065D	TV SOUND SYSTEM	.75
3086D	TRANSISTOR ARRAY	1.25
4131H,M	HIGH GAIN OP AMP	.50
4136D	QUAD LO NOISE OP AMP	1.50
4194D	50 MA ± TRACKING REGULATOR	1.50
4194TK	200 MA ± TRACKING REGULATOR	2.50
4195TK	200 MA ±15 VOLT REGULATOR	2.25
4250H	PROGRAMMABLE OP AMP	1.00
4739D	DUAL LO NOISE OP AMP	1.00
4741H	DUAL 741 OP AMP	.50
5556M	SEE 1556M	
5558M	DUAL 741 OP AMP	.85
8038D	VCO SINE/SQ/TRI FUNC GEN	4.50

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SPECIALS FROM MHz electronics

Fairchild VHF Prescaler Chips

11C01FC	High Speed Dual 5-4 Input ns/nor	15.40
11C05DC	1 GHz Counter Divide by 4	74.35
11C05DM	1 GHz Counter Divide by 4	110.50
11C06DC	UHF Prescaler 750 MHz D Type flip/flop	12.30
11C24DC	Dual TTL VCM same as MC4024P	2.60
11C44DC	Phase Freq. Detector same as MC4044P	2.60
11C58DC	ECL VCM	4.53
11C70DC	600 MHz flip/flop with reset	12.30
11C83DC	1 GHz 248/256 Prescaler	29.20
11C90DC	650 MHz Prescaler Divide by 10/11	16.00
11C90DM	same as above except Mil. version	24.00
11C91DC	605 MHz Prescaler Divide by 5/6	16.00
11C91DM	same as above except Mil. version	24.00
95H90DC	350 MHz Prescaler Divide by 10/11	9.50
95H90DM	same as above except Mil. version	16.50
95H91DC	350 MHz Prescaler Divide by 5/6	9.50
95H91DM	same as above except Mil. version	16.50

T.I. TMS4060/C2107, 4K RAM 19.01

Batteries

NI-CAD's AA cells 1.25 volts at 500 mahr. $0.49
Gel-Cell 12 volts at 1.5 Amp Hr. #GC-1215 $19.95

Crystals

1.000000 MHz	4.95
5.000000 MHz	4.95
10.000000 MHz	4.95
3579.545 KC	2.95

JUST ARRIVED! These radios have just been pulled out of service. Set up for approx. 150 MHz. Clean. All tubes included. No accessories. Prices FOB Phoenix.

Motorola U43 GGT	$49.95
GE TPL	$99.95
GE MT-33	$39.95
Collins 26U	$150.00
CBS Labs Model IIIs, AUDIMAX	$775.00
CBS Labs 450	$375.00
Gates CB77 (needs arm)	$75.00

NEW

Motorola, Motorcycle Radio — Model T33BAT $39.95 FOB Phoenix

Motorola MC14410CP CMOS tone Generator uses 1 MHz Crystal to produce standard dual frequency telephone dialing signal. Directly compatible with our 12 key Chomeric pads. Kit includes the following.

1 MC14410CP
1 Touch Tone Pad
1 1 MHz Crystal
1 Printed Circuit Board (From Ham Radio Sept. 1975)
And all other parts for assembly. $19.95

Fairchild 95H90DC Prescaler divide by 10 to 350 MHz. Will take any 35 MHz Counter to 350 MHz. Kit includes the following.

1 95H90DC
1 2N5179
2 UG-88/u BNC's
1 Printed Circuit Board
And all other parts for assembly. $29.95

Fairchild 11C90DC Prescaler divide by 10 to 650 MHz. Will take any 65 MHz Counter to 650 MHz or with a 82S90 it will divide by 10/100 to 650 MHz. This will take a 6.5 MHz counter to 650 MHz. Kit includes the following.

1 11C90DC
1 2N5179
2 UG-88/U
1 MC7805CP
1 Bridge
1 Printed Circuit Board and all other parts for assembly.
82S90 add $5.70 to total. $59.95

10.7 MHz Ceramic Filter
MuRata SFW10.7MA $3.95

Johanson and Johnson Trimmer Capacitors

1 to 14 pf. $1.95
1 to 20 pf. $1.95

Ferrite Beads

12 for .99 or
120 for 9.99

FET's

2N3070	1.50	2N5460	.90	MFE3002	3.35
2N3436	2.25	2N5465	1.35	MPF102	.45
2N3458	1.30	2N5565	5.45	MPF121	1.50
2N3821	1.60	3N126	3.00	MPF4391	.80
2N3822	1.50	MFE2000	.90	U1282	2.50
2N4351	2.85	MFE2001	1.00	MMF5	5.00
2N4416	1.05	MFE2008	4.20	40673	1.39
2N4875	1.75	MFE2009	4.80	40674	1.49

TUBES

2E26	5.00	811	6.95	7984	4.95
3B28	4.00	811A	9.95	8072	32.00
4X150A	15.00	931A	11.95	8156	3.95
4X150G	18.00	5849	32.00	8908	9.95
4CX250B	24.00	6146A	8.25	8950	5.50
4CX350A/8321	35.00	6146B/8298A	8.25	4-400A	29.95
DX415	25.00	6360	7.95	4-250A	24.95
572B/T160L	25.00	6907	35.00	4-125A	20.95
		7377	40.00	4-65A	15.95

TRANSFORMERS

F-21A	6.3vct at 10 amps	5.77
F-18X	6.3vct at 6 amps	3.56
F-93X	6.5v to 40v at 750 ma.	3.53
F-92A	6.5v to 40v at 1 amp	4.59
F-91X	6.5v to 40v at 300 ma.	2.72
N-51X	Isolation 115vac at 35va.	2.80
Model D-2	6.5v at 3.3 amps	4.95
C-912-034	6.5v at 3.3 amps 22vct at 200 ma. 11v at 250 ma.	1.49
BE-12433-001	30v at 15 ma.	.49
C-404-024	18vct at 400 ma.	1.49
BGH-9	6.3vct at 10 amps 115 vac at 100va Isolation	6.95
F-107Z	12V @ 4A or 24 V @ 2A	7.80

Erie High Voltage Power Supply

TSK-209-000
Input 24vdc
output #1 100 vdc — 12.95
#2 400 vdc +
#3 15000 vdc
Size: 3½" x 2" x 2¾"
This power supply was used in a CRT Terminals

DIODES

1N270 Germanium Diodes $7.95/c
HEP170, 2.5A, 1000 PIV $4.95/20
Semtech SFMS 20K, 20KV, 10 ma, fast recovery $1.26 ea.

FANS

Pamotor Fans, Model 4500C 117 VAC, 60 Hz, 19 w. $7.95

RF TRANSISTORS

2N1561	15.00			2N5590	6.30
2N1562	15.00	2N3866 JAN TX	4.85	2N5591	10.35
2N1692	15.00	2N3925	6.00	2N5635	4.95
2N1693	15.00	2N3927	11.50	2N5636	11.95
2N2631	4.20	2N3948	2.00	2N5637	20.70
2N2857	1.80	2N3950	26.25	2N5643	20.70
2N2876	12.35	2N3961	6.60	2N5641	4.90
2N2880	25.00	2N4072	1.70	2N5643	20.70
2N2927	7.00	2N4073	2.00	2N5764	27.00
2N2947	17.25	2N4135	2.00	2N5841	11.00
2N2948	15.50	2N4427	1.24	2N5842/MM1607	19.50
2N2949	3.90	2N4430	20.00	2N5849/MM1622	19.50
2N2950	5.00	2N4440	8.60	2N5852	50.00
2N3287	4.30	2N4957	6.30	2N5942	49.50
2N3300	1.05	2N5070	13.80	2N5922	10.00
2N3302	1.05	2N5090	6.90	2N6080	5.45
2N3307	10.50	2N5108	3.90	2N6081	8.60
2N3309	3.90	2N5109	1.55	2N6082	11.25
2N3375/MM3375	7.00	2N5177/MRF5177	20.00	2N6083	12.95
2N3553	1.80	2N5179	.68	2N6084	14.95
2N3571	4.10	2N5180	.83	2N6094	5.75
2N3818	6.00	2N5184		2N6095	10.35
2N3824	3.20	2N5216	47.50	2N6096	19.35
2N3866	1.09	2N5583	5.60	2N6097	28.00
2N3866 JAN	4.14	2N5589	4.60	2N6166	85.00

RF TRANSISTORS

MRF207	2.00	Amperex BLY90	22.50	MM3002	1.65
MRF208	10.20	Amperex A209	8.60	MM3009	1.80
MRF209	12.35	MSC 2001	20.00	MM3375	7.00
MRF237	1.85	MSC 3000	20.00	MM3904	1.50
MRF238	8.55	MSC 3001	20.00	MM3906	1.43
MRF450	16.55	MSC 3005	20.00	MM4000	1.24
MRF453	19.55	MSC 80205	20.00	MM4001	1.39
MRF504	6.75	MSC 80206	20.00	MM4003	1.85
MRF509	5.50	MSC 80255	20.00	MM4036	1.60
MRF511	8.60	Fairchild SE7056	3.00	MM4044	3.00
MRF620	27.00	MM1051	2.00	MM4545	3.00
MRF8004	1.90	MM1500	32.20	MM8006	2.15
HEPS3013/75	2.95	MM1550	10.00	MM1552	30.00
HEPS3014/76	4.95	MM1601	5.50	MM1553	56.50
HEPS3002	11.03	MM1602	7.50	HEPS5026	2.48
HEPS3003	29.88	MM1607/2N5842	8.65	MSC 80256	20.00
HEPS3005	9.55	MM1614	2.75	CTC D1-28	20.00
HEPS3006	19.90	MM1620	17.50	CTC D10-28	20.00
HEPS3007	24.95	MM1622/2N5849	19.50	CTC E1-28	20.00
HEPS3008	2.18	MM1661	15.00		
HEPS3010	11.34	MM1669	17.50		
RCA TA7994	50.00	MM1943	3.00		
RCA 40290	2.48	MM2605	3.00		
Kertron K2126	5.50	MM2608	5.00		
Kertron KB6008	5.50				

MHz electronics

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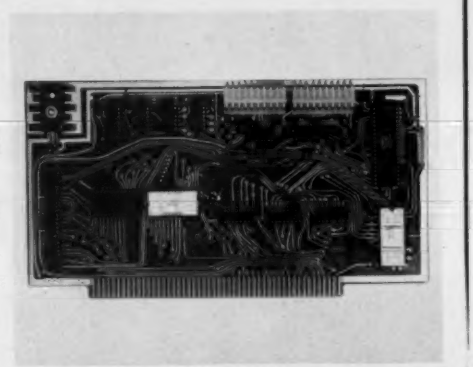
PH. 602-957-0786

NO C.O.D.

DIGITAL DATA RECORDERS

USING 3M DATA CARTRIDGES



MODEL 3M3 – $199.95
(Price increases to $220 effective 1 April 1977)

2SIO (R) CONTROLLER – $190.00

MODEL 3M3
Featuring the radically new "Uniboard" method of construction for data cartridge drives. The major computer makers are changing to cartridges at a rapid pace because of the freedom from binding and greater data reliability. Operates in the phase encoded self-clocking mode which provides greatly enhanced freedom from speed variation problems and allows 100% tape interchangeability between units.

Uses the 3M Data Cartridge, model DC 300. This cartridge contains 300 feet of .250 tape in a sealed plastic container. Using four tracks you can record nearly 2 megabytes of data on a cartridge.

SPECIFICATIONS:
Full software control of record, play, fast forward and rewind. LED indicates inter-record gaps. EOT and BOT are sensed and automatically shut down recorder. Feedback signals send reset and inter-record gap signals back to the computer so that software searching for inter-record gaps at high speed can be accomplished. Can also be operated manually by means of the switches on top which parallel the software control signals. $199.95 until April 1, 1977. $220.00 after April 1, 1977. Includes Phase Encoder Board (ACI).

FOR 8080, 8085, AND Z80 USERS
Comes complete with software listing for the programs in the 2SIO (R) ROMs. Can be controlled by any of the commonly used I/O boards. Send for complete documentation and interfacing instructions on 3M3 and 2SIO (R) ($3.00). These programs provide full software control.

2SIO (R) CONTROLLER (BOOTSTRAP ELIMINATOR)
This is a complete 8080, 8085, or Z80 system controller. It provides the terminal I/O (RS232, 20 mA, or TTL) and the data cartridge I/O, plus the motor controlling parallel I/O latches. One kilobyte of on board ROM provides turn on and go control of your Altair or Imsai. No more bootstrapping. Loads and Dumps memory in hex on the terminal, formats tape cartridge files, has word processing and paper tape routines. Best of all, it has the search routines to locate files and records by means of six, five, and four letter strings. Just type in the file name and the recorder and software do the rest. Can be used in the BiSync (IBM), BiPhase (Phase Encoded) or NRZ modes with suitable recorders and interfaces. $190, wired and tested; $160, kit form.

AUDIO CASSETTE INTERFACE (ACI)
This is the phase encoding board used in the 3M3. Additional components on the board enable you to use audio recorders in the KC standard or the new PE 2400 (2400 baud) systems. Can also be used for Tarbell if you have an 8251 Intel I/O chip. Required if you use an audio cassette with the 2SIO (R) above. $50, wired and tested; $35, kit form.

For 6800 Users: Software programs and I/O board for SWTP are under development. Limited software available now. Ask for 6800 data with $3.00 Documentation package. These programs will provide full software control.

CARTRIDGE AVAILABILITY
Cartridges are made by 3M, ITC, Wabash and others. They are available at all computer supply houses and most major computer service centers. We can supply them at normal current list prices.

"COMPUTER AID" and "UNIBOARD" are trademarks of the NATIONAL MULTIPLEX CORPORATION. The 3M Data Cartridges are covered by 3M Patents and Marks. "UNIBOARD" Patents Pending.

OVERSEAS: EXPORT VERSION – 220 V – 50 Hz. Write factory or – Megatron, 8011 Putzbrunn, Munchen, Germany; Nippon Automation 5-16-7 Shiba, Minato-Ku, Tokyo; Hobby Data, FACK 20012, Malmo, Sweden; G. Ashbee, 172 Ifield Road, London SW 10-9AG.

For U.P.S. delivery, add $3.00 . Overseas and air shipments charges collect. N.J. Residents add 5% Sales Tax. WRITE or CALL for further information. Phone Orders on Master Charge and BankAmericard accepted.

NATIONAL MULTIPLEX CORPORATION

3474 Rand Avenue, South Plainfield NJ 07080, Box 288. Phone (201) 561-3600 TWX 710-997-9530.

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Chattanooga TN 37401

Save Time with a Micro OS

-- isn't that what computers are for?

So what's an operating system (OS) and why do I need one? I don't actually know the "dictionary" definition of an OS, but my understanding is that an OS is rather similar to the family of programs we commonly call monitors, except an OS is much more powerful and has more bells and whistles. The Mikbug* monitor in the SWTPC M6800 is an example of a nice little monitor; it removes much of the work of using a computer (no bootstrapping, just turn on the power), but leaves much to be desired. Mikbug will load a program from tape, but if you have several programs on the same tape, it loads the first one it encounters. You still have to find the desired program before telling Mikbug to load it. The WA4KDC OS will search a tape for the desired program, loading only the one you've chosen. This is but one feature of the OS. The reason I felt the need for an OS is twofold: First, I happen to believe that a computer should do as much as possible because second, I'm lazy. The WA4KDC OS is not meant to replace Mikbug but to be used along with it.

*Mikbug is a registered trademark of Motorola, Inc.

No listing has been provided with this article. Instead, a dump has been provided. This was done in the hope that Wayne would find room to print it, as a dump takes up less page space than a listing of the same information. Should you desire a listing, the OS itself can provide you with one!

As the OS was written for my system, several assumptions are made:

1. The Mikbug monitor ROM and its associated 128 byte RAM are in place in the system.
2. An SWTPC CT-1024 is used as the control terminal.
3. Tape read and write facilities are available at

```
0000  42 4C 4F 43 4B 20 4D 4F 56 45 04 43 41 4C 4C 20
0010  42 41 53 49 43 04 44 55 4D 50 04 4C 49 53 54 04
0020  4D 49 4B 42 55 47 04 52 45 41 44 04 57 52 49 54
0030  45 04 20 54 41 50 45 04 5A 45 52 4F 20 4D 45 4D
0040  4F 52 59 20 3F 20 04 54 4F 04 53 54 41 52 54 04
0050  53 54 4F 50 04 53 39 04 10 16 04 0D 0D 0A 04 CE
0060  00 58 7E E0 7E 8D FB CE 00 5C 20 F6 8D F4 CE 00
0070  43 20 EF 8E A0 42 8D E7 CE 00 00 8D E8 CE 00 0B
0080  8D E3 CE 00 16 8D DE CE 00 1B 8D D9 CE 00 20 8D
0090  D4 CE 00 27 8D CC CE 00 32 8D CA CE 00 2C 8D C2
00A0  CE 00 32 8D C0 CE 00 38 8D B8 BD E1 AC 81 42 26
00B0  04 8D 3B 20 BE 81 43 26 03 7E 01 40 81 44 26 05
00C0  BD 01 5B 20 EE 81 4C 26 05 BD 02 11 20 E5 81 4D
00D0  26 05 BD E0 E3 20 DC 81 52 26 03 BD 02 A6 81 57
00E0  26 03 7E 02 DD 81 5A 26 CA BD 03 BA 20 C5 BD 00
00F0  5F CE 00 00 BD E0 7E CE 00 47 BD 00 6C BD E0 47

0100  FF A0 00 BD 00 67 CE 00 4A BD 00 6C BD E0 47 FF
0110  A0 02 BD 00 67 CE 00 50 BD 00 6C BD E0 47 FF A0
0120  04 FE A0 02 A6 00 BC A0 04 26 06 FE A0 00 A7 00
0130  39 08 FF A0 02 FE A0 00 A7 00 08 FF A0 00 20 E1
0140  CE 01 00 FF A0 00 CE C0 00 FF A0 02 CE D1 50 FF
0150  A0 04 8D CD BD 00 5F 7E 01 00 01 BD 00 5F CE 00
0160  4A BD E0 7E CE 00 16 BD 00 6C 5F 37 20 24 5F 37
0170  BD E1 AC 81 53 26 07 CE 00 5C 8D 59 33 39 81 46
0180  27 19 CE A0 0C 4F AB 01 A7 01 86 FF A9 00 A7 00
0190  20 09 BD E0 55 B7 A0 0C 7F A0 0D CE 00 5B 8D 35
01A0  CE A0 0C 8D 1C 5F FE A0 0C 8D 18 5C C1 08 26 F9
01B0  FF A0 0C 33 5C C1 10 27 B5 37 CE 00 5C 8D 16 20
01C0  DF 8D 06 8D 04 86 20 20 21 A6 00 8D 0F A6 00 08
01D0  20 0E 8D 16 08 A6 00 81 04 26 F7 39 44 44 44 44
01E0  84 0F 8B 30 81 39 23 02 8B 07 FF A0 14 37 CE 80
01F0  0C C6 FF E7 00 C6 3F E7 01 8D 05 33 FE A0 14 39
```

the control terminal, and are under software control.

4. An SWTPC PR-40 printer is used for hard copy, and is located at I/O slot #3 (if your PR-40 is at another I/O slot, memory locations 01EF-01F0 will have to be changed to the address of the slot you are using).

As it appears in this article, the WA4KDC OS is assembled to run at 0000-03EB, but it is not really intended to be used there. It was designed to be placed into PROM (along with your favorite version of BASIC) and moved somewhere at the high end of memory, OS 8C00 and BASIC C000-DFFF in my system. All functions except CALL BASIC may be used as it appears here, but the OS will have to be moved higher in memory if the CALL BASIC feature is to be used as will be explained later. The reason the OS is shown here assembled for the low end of memory is because the author has no way of knowing where in memory you will wish to use it, and most people seem to find it easier to relocate a program from the low end of memory.[1]

The WA4KDC OS contains several subroutines for the purpose of outputting data to the PR-40. They are equivalent to subroutines contained in Mikbug and may be called by user programs. They are listed below by address along with the name of the Mikbug subroutines to which they are equivalent.

01C1 – OUT4HS
01C3 – OUT2HS
01C5 – OUTS
01D5 – PDATA1
01EA – OUTEEE

Once you have loaded the OS into memory, set the program counter (A048-A049) to 0073 while in Mikbug; then type "G" to go to the operating system and begin execution. The OS should respond by issuing a "home-up" and "erase to end of frame" on the control terminal, then print the following:

BLOCK MOVE
CALL BASIC
DUMP
LIST
MIKBUG
READ TAPE
WRITE TAPE
ZERO MEMORY ?

The OS will now respond to the following commands: "B", "C", "D", "L", "M", "R", "W", or "Z" (the first letter of each function); typing anything else on the control terminal will cause the OS to repeat the above cycle. Let's examine each function of the OS in a bit of detail.

BLOCK MOVE: Suppose we have a routine located A04A through A060 that we wish to relocate to another area of memory beginning with a starting address of 0200. From the OS main loop, we type B for the BLOCK MOVE function. The OS will then prompt:

MOVE TO ? (we type) 0200
START MOVE ? (we type) A04A
STOP ? (we type) A060

The OS will then move the data, leaving the data in A04A through A060 (in our example) intact, and return to the OS main loop to wait for further commands. The BLOCK MOVE function will move as little as one byte or as much as ½ of the available memory. This function is accomplished very rapidly and irrespective of the amount of data moved; it appears to the operator to instaneously return to the OS main loop!

CALL BASIC: Typing C while in the OS main loop causes BASIC to be automatically block moved from some high location in memory to the low end of memory where it is to be used. (This is the reason the OS cannot be located at the low end of memory if the CALL BASIC function is to be used – it would try to move BASIC on top of itself!) The following addresses should contain the information shown below:

0141-0142 – Address BASIC is to be moved to (as in the "MOVE TO?" of the BLOCK MOVE function)
0147-0148 – Lowest address of BASIC ROM
014D-014E – Highest address of BASIC ROM
0158-0159 – Starting address of BASIC

[1] **Relocating the WA4KDC OS is made easy by using the BLOCK MOVE and the LIST functions of the OS to identify those addresses that have to be altered, even though relative addressing has been used extensively.**

0200	A7	00	C6	37	E7	01	C6	3F	E7	01	6D	01	2A	FC	E6	00
0210	39	BD	00	5F	CE	00	4A	BD	E0	7E	CE	00	1B	BD	00	6C
0220	BD	E0	47	FF	A0	02	BD	00	67	CE	00	50	BD	00	6C	BD
0230	E0	47	FF	A0	04	FE	A0	02	FF	A0	0C	CE	00	5C	BD	01
0240	D5	CE	A0	0C	BD	01	C1	FE	A0	0C	A6	00	B7	A0	0B	BD
0250	01	C3	FF	A0	0C	BD	01	C5	5F	B6	A0	0B	81	8C	27	18
0260	81	8E	27	14	81	CE	27	10	84	F0	81	20	27	0B	81	60
0270	25	08	84	30	81	30	26	01	5C	5C	F7	A0	0A	27	10	7A
0280	A0	0A	27	05	BD	01	C1	20	03	BD	01	C3	FF	A0	0C	B6
0290	A0	0C	B1	A0	04	27	02	20	A2	B6	A0	0D	B1	A0	05	23
02A0	F6	86	0D	7E	01	EA	BD	00	5F	CE	00	27	BD	00	6C	8D
02B0	1E	86	3C	B7	80	07	86	11	BD	E1	D1	CE	A0	4A	BD	E1
02C0	AC	A1	00	26	F6	08	A6	00	81	04	26	F2	BD	E0	13	CE
02D0	A0	4A	BD	E1	AC	A7	00	08	81	04	26	F6	39	8E	A0	7F
02E0	BD	00	5F	CE	00	32	BD	00	6C	8D	E4	BD	00	67	CE	00
02F0	4A	BD	E0	7E	CE	00	32	BD	00	6C	BD	E0	47	FF	A0	02
0300	BD	00	67	CE	00	50	BD	E0	7E	CE	00	32	BD	00	6C	BD
0310	E0	47	FF	A0	04	BD	00	67	CE	00	4A	BD	00	6C	BD	E0
0320	47	FF	A0	48	86	12	BD	E1	D1	8D	2A	CE	A0	4A	BD	E0
0330	7E	8D	2E	CE	A0	48	FF	A0	02	08	FF	A0	04	8D	22	8D
0340	0E	8D	0C	8D	0A	8D	0E	86	14	BD	E1	D1	7E	00	73	CE
0350	00	55	7E	E0	7E	5F	86	00	BD	E1	D1	5C	C1	FF	26	F6
0360	39	FE	A0	02	FF	A0	0F	B6	A0	05	B0	A0	10	F6	A0	04
0370	F2	A0	0F	26	04	81	10	25	02	86	0F	8B	04	B7	A0	11
0380	80	03	B7	A0	0E	CE	E1	34	BD	E0	7E	5F	CE	A0	11	8D
0390	24	CE	A0	0F	8D	1F	8D	1D	FE	A0	0F	8D	18	7A	A0	0E
03A0	26	F9	FF	A0	0F	53	37	30	8D	0B	33	FE	A0	0F	09	BC
03B0	A0	04	26	B3	39	EB	00	7E	E0	BF	BD	00	5F	CE	00	4A
03C0	BD	E0	7E	CE	00	38	BD	E0	7E	BD	E0	47	FF	A0	02	BD
03D0	00	67	CE	00	50	BD	00	6C	BD	E0	47	FF	A0	04	FE	A0
03E0	02	6F	00	08	BC	A0	04	26	F8	6F	00	39	00	00	00	00
03F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Upon completion of the CALL BASIC function, system control is given to the BASIC interpreter instead of returning to the OS main loop. This function is also accomplished very quickly with the BASIC prompt seeming to appear as soon as the "C" command is typed – no more waiting for fifteen or twenty minutes for BASIC to load! (Tom Pittman's TINY BASIC and the WA4KDC Operating System will fit into 3K of PROM with room to spare!)

DUMP: Suppose we desire a "Core Dump" beginning with address 1000. Typing D while in the OS main loop will cause the OS to prompt with:

```
START DUMP ? (we type) 10
```

The OS will then print (using the PR-40) 128 bytes in standard core dump format beginning at address 1000. After dumping 128 bytes to the PR-40, the OS looks for one of three commands:

```
B – Dump the next frame back (lower address)
F – Dump the next frame forward (higher address)
S – Stop dump and return control to OS main loop
```

LIST: The LIST function of the OS, while similar to the DUMP function, uses the following format: address, OP code, operand. Suppose we wish a listing of 01BA through 01BF. Typing L while in the OS main loop will cause the OS to prompt with:

```
START LIST ? (we type) 01BA
STOP ? (we type) 01BF
```

Assuming that we have the OS in memory locations 0000 through 03EB, the OS should then print (using the PR-40):

```
01BA CE 005B
01BD 8D 16
01BF 20 DF
```

Upon completion of the LIST function, control is returned to the OS main loop. It should be noted that ASCII encoded strings tend to confuse the poor OS. Once beyond the strings, it will usually recover rather rapidly.

READ TAPE: As mentioned earlier, the OS will search for a particular program on tape and load only the desired program (assuming the tape is formatted with a header record for identification – see WRITE TAPE). While in the OS main loop, if an R command is typed, the OS will prompt with:

```
READ ?
```

At this point, the OS is requesting the name of the program you desire it to load into memory. After entering the name of the program, type a "Control D" to indicate to the OS that the entry is complete. The OS will then turn on the tape reader and begin searching for the desired program. When it is found, it will be read into memory; everything encountered on the tape before the desired program will be ignored. After the program has been read into memory, system control is given to Mikbug, so typing "G" will run the program.

WRITE TAPE: The WRITE TAPE function of the OS outputs programs to tape in the following format: header, header record, program, program counter starting location, three S9s, trailer. The header, a series of nulls, gives a cassette recorder time to reach normal tape speed before any data is output to tape. The header record (name of program) identifies the program to the READ TAPE function when, at some later time, it is desired to load the program from tape. The three S9s indicate the end of program to the OS when the tape is later read into memory. The trailer, a series of nulls, is added to provide some physical spacing between programs on tape. Let's assume we have Star Trek in memory from 0000 to 1FFF, with an entry point of 0100, and we desire a tape of it. While in the OS main loop, we type the WRITE TAPE command, "W", and the OS prompts with:

```
WRITE ? (we type) STARTREK
"Control D" ("Control D" indicates end of entry to the OS)
START TAPE ? (we type) 0000 (lowest address of program)
STOP ? (we type) 1FFF (highest address of program)
START ? (we type) 0100 (program entry point)
```

The OS will then turn the recorder on, generate the tape (formatted as described above), turn the recorder off, return control to the OS main loop.

ZERO MEMORY: This function will clear any amount of memory from one byte up to the entire RAM memory in the system; it appears to the operator to perform its task even faster than the BLOCK MOVE function! The first time you use the ZERO MEMORY function, you may wish to go to the Mikbug memory examine function and do some random checking to prove to yourself that the OS actually did clear the memory! To clear the memory used in the Star Trek example above, type a Z (while in the OS main loop, of course). This will cause the OS to prompt with:

```
START ZERO MEMORY ? (we type) 0000
STOP ? (we type) 1FFF
```

Upon completion of the ZERO MEMORY function, system control is returned to the OS main loop.

MIKBUG: This function turns system control to the Mikbug control loop. You may, while in Mikbug, return to the WA4KDC OS by typing G.

Although considerable effort has been expended to assure that the WA4KDC Operating System is "bug free," and it has been running on our system for some time with no known bugs, we would be most interested in hearing about any bugs you may find. ■

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NOTES
1. Models prefaced ' ** ' will be available 1/77.
2. All models above are furnished with crimp/solder lugs.
3. All models can be furnished with a SO-239 female coaxial connector at additional cost. The SO-239 mates with the standard PL-259 male coaxial cable connector. To order this factory installed option, add the letter 'A' after the model number. Example: 40-20 HD/A.
4. 75 meter models are factory tuned to resonate at 3950 kHz. (SP) models are factory tuned to resonate at 3800 kHz. 80 meter models are factory tuned to resonate at 3650 kHz. See VSWR curves for other resonance data.

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80-40 HD	80/40 + 15	57.50	41/1.15	69/21.0
75-40 HD	75/40	55.00	40/1.12	66/20.1
75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
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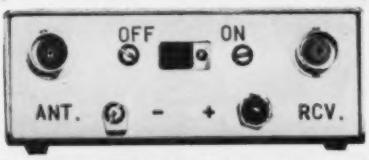

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PROM Message Generator for RTTY

- - keyboards are obsolete!

This article describes what started out to be a simple CW identifier mainly for repeater use. The circuit, however, can easily be changed to send almost any length or type of message. Some possible uses are a CW identifier, Morse code message generator, RTTY test message generator (RYs, the quick brown fox . . .), RTTY message generator, and an automatic telephone dialer.

Three of the basic CW identifier circuits have been built. The first one has been operating in the WR4AKK repeater since Christmas of 1974. The second one was built for WB4CCB, who uses it to identify himself on VHF. And, finally, seven months after the circuit was designed, I built one for myself. I should mention that the first two identifiers were a combination of TTL and CMOS logic. But, because most hams are not yet familiar with the peculiarities of CMOS, I redesigned the circuit using all TTL.

The Memory Unit

For the memory unit, I chose to use a field programmable read only memory or PROM. PROMs are now appearing on the surplus market at prices that the average ham can afford. PROMs are smaller and easier to work with than a diode matrix, are easy to design with, and — believe it or not — most are easy to program.

A PROM can be thought of as a black box that has X number of inputs and Y number of outputs. What goes on inside during operation really doesn't need to concern us at this point. PROMs are sold with all the output stages in the same logic state, either 1 or Ø. Whether the output stages are initially all 1s or Øs depends on the manufacturer. During the programming process, you, the user, decide for a

Address	Output state	Represents:
0	1	dit
1	0	space
2	1	
3	1	dah
4	1	
5	0	space
6	1	
7	1	dah
8	1	

Table 1. Address locations and memory content to send Morse code W.

Address	Output state	Represents:
0	1	
1	1	dah
2	1	
3	0	space
4	1	dit
5	0	space
6	1	
7	1	dah
8	1	
9	0	space
10	1	dit
11	0	
12	0	letter space
13	0	
14	1	
15	1	dah
16	1	
17	0	space
18	1	
19	1	dah
20	1	
21	0	space
22	1	dit
23	0	space
24	1	
25	1	dah
26	1	
27	0	
28	0	word space
29	0	
30	0	
31	0	
32	0	
33	1	
34	1	dah
35	1	
36	0	space
37	1	dit
38	0	space
39	1	dit
40	0	
41	0	letter space
42	0	
43	1	dit
44	0	space

Addresses 0 through 10 send a C
Addresses 14 through 26 send a Q
Addresses 33 through 39 send a D
Address 43 sends a E

Table 2. Address locations and memory content to send CQ DE.

Address	A_3 8	A_2 4	A_1 2	A_0 1	= binary weights
0	0	0	0	0	
1	0	0	0	1	
2	0	0	1	0	
3	0	0	1	1	
4	0	1	0	0	
5	0	1	0	1	
6	0	1	1	0	
7	0	1	1	1	
8	1	0	0	0	
9	1	0	0	1	
10	1	0	1	0	
11	1	0	1	1	
12	1	1	0	0	
13	1	1	0	1	
14	1	1	1	0	
15	1	1	1	1	

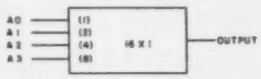

Fig. 1. A simple four input, one output (16 x 1) PROM showing address decoding.

specific address what the output states will be and program accordingly. For example, if you want output one to be a Ø for address 3, and the PROM has all outputs initially at Ø, you do not have to program anything into address 3. If, however, you want output one to be a 1, you must apply a programming voltage to the PROM to cause this output to change. (For programming information see the specific manufacturer's spec sheet.) Once an output has been programmed, it cannot be changed. (Some of the newer MOS PROMs can be erased and reprogrammed, but the entire PROM must be erased – not just one word or one bit at a time.)

The input lines to a PROM are called address lines. Each address selects one word. For example, a Ø on all address lines selects word zero. An address is the sum of the binary weights of the address lines. Address line AØ has a binary weight of 1, address line A1 has a binary weight of 2, address line A2 has a binary weight of 4, and so on. Fig. 1 shows a four input PROM and its address table. This PROM has a maximum capability of sixteen words, with addresses zero through fifteen. For every input address there is at least one output stage which is unique to that address. The output stages are tied to each other in groups. That is, if there are four outputs for each address, all of the output one stages (for every address) are tied together, all of the output two stages are tied together, and so on. Even though the output stages for every address are common to each other, only the output stages corresponding to the selected address are active. For example, for a four output PROM every address activates four outputs. These outputs can be any combination of 1s and Øs and are programmed separately.

PROMs are available with three types of output stages: Totem-pole, open collector, and Tri-state (Tri-state is a trademark of National Semiconductor Corp. for their three-state output devices). The Totem-pole output PROM is a new product just released by Harris Semiconductor. It features a standard TTL output stage.

Three-state PROMs have an enable input which, when it is taken high, will force all of the outputs to a very high impedance. This allows several outputs to be bused together. Three-state PROMs also have internal pullup resistors on the output lines. These resistors insure that when an output is high, the output will be close to +Vcc.

Open collector PROMs also have an enable input. When this input is high, all of the outputs are forced off. Open collector PROMs do

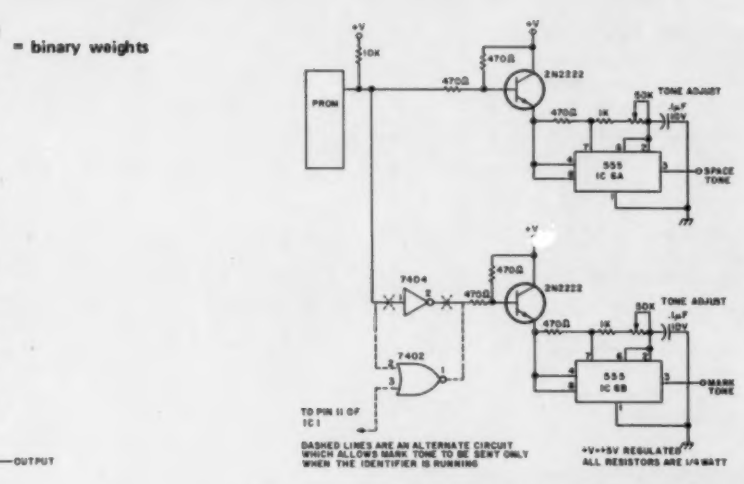

Fig. 3. A modification to the tone generator of Fig. 2 to allow two-tone operation for RTTY use.

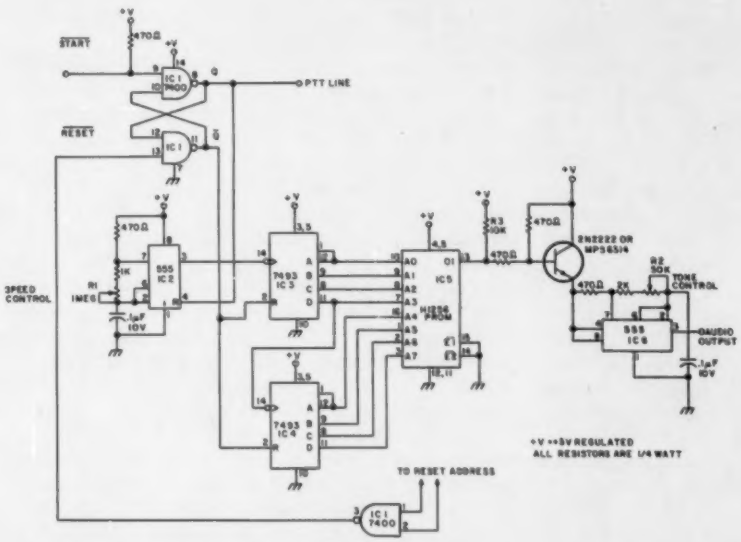

Fig. 2. The basic CW identifier. This circuit features adjustable speed, adjustable tone, and up to 256 bits of memory. The PROM pinout is for a Harris 1256, 256 x 1 PROM.

not have internal pullup resistors. To insure that the output does go to a logic 1 when we want it to, an external pullup resistor must be connected from the output to the +Vcc supply.

A PROM with four inputs and one output is called a 16 word by 1 bit (16 x 1) PROM. If a PROM has eight inputs and four outputs (a common configuration), it is a 256 word by 4 bit (256 x 4) PROM.

Circuit Description

IC1 is a 7400, two gates of which form the ID start flip-flop (Fig. 2). If pin 9 of IC1 is momentarily taken low, pin 8 of IC1 goes and stays high. This high level turns on IC2, a 555 astable multivibrator, which provides the clock signal for driving the counters. At the same time that pin 8 goes high, pin 11 goes low, allowing the two 7493 four bit binary counters to begin counting. IC3, a 7493, counts on the negative transition of the clock. IC3 addresses the PROM from Ø (A0-A7 low), to address 15 (A0-A3 high, A4-A7 low). When the next negative transition of the clock occurs, IC3 changes back to Ø and IC4, another 7493, advances to count 1. This corresponds to address 16 (A4 high, A0-A3 and A5-A7 low). In this manner the PROM is sequentially addressed starting at address Ø and ending at the maximum address of the PROM. In the case of this 256 x 1 PROM, when the counters reach 255, the maximum address has been reached. At clock count 256 the PROM will be back at address Ø. The counters will continue counting and the PROM will be addressed through its entire contents again and again. To stop the counters and reset them at the end of your message, one, two, or three address lines are decoded with a NAND gate to detect the reset address. When all of the inputs to the NAND gate are high, indicating the reset address has been reached, the gate's output goes low, applying a reset pulse to pin 13 of IC1. When pin 13 is taken low, pin 8 of IC1 goes low, stopping the 555 clock, and pin 9 goes high, resetting the 7493 counters. For example, to send my call, WB4EHG, requires 6Ø address locations. Sixty is represented by address lines A2, A3, A4, and A5 being high at the same time. To reset at address 6Ø would require a four input NAND gate. But, if I were to reset at address 64 (A6 high only) instead, I can use one of the unused gates in IC1. For addresses 61, 62, 63 and 64, the PROM output must be Ø. If the output were 1 for these addresses, a tone would be sent by the tone generator. It's a good idea to program a few addresses low after your message, to insure that the message is complete and the tone generator is off before and during reset.

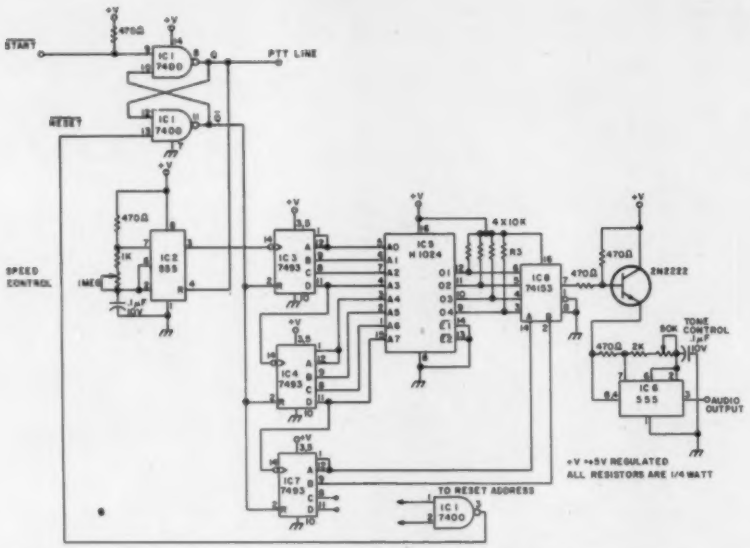

Fig. 4. An expanded identifier. This circuit features adjustable speed, adjustable tone, and up to 1024 bits of memory. The PROM pinout is for a Harris 1024, 256 x 4 PROM.

Resistor R3 provides the pullup current to the output stage of the PROM. The use of this resistor was discussed earlier in this article. When the output of the PROM is high, as it is when you wish a tone output, transistor Q1 is turned on, which turns on IC6 by raising its Vcc line from +2.5 V to +5.0 V. IC6 is a 555 astable multivibrator which serves as a tone oscillator. By using Q1 as a keying switch and keying the Vcc line, the oscillator turns on without producing a key click. R2, the 50k Ohm pot, is a tone control. The tone frequency can be varied between 100 Hz and 2.5 kHz.

An external tone oscillator may be used as long as you properly interface it to the PROM output. Most PROMs will drive ten standard TTL loads (16 mA output); but, if you are in doubt, check the manufacturer's specifications.

If you are building a RTTY message generator, the tone generator circuit of Fig. 3 can be used. This circuit has two 555s, one to generate the mark tone and the other to generate the space tone. An inverter is needed between the PROM output and the mark tone generator. The fourth gate of IC1 can be used or you can add another IC.

Code Programming

Now that we know how the addressing is going to take place, let's take a look at what each address is going to do. Morse code is made up of dits and dahs. Each dah is equal in length to three dits. Each address, therefore, will be equal to one dit length. If one lone address has a one programmed in its output, it will turn on the tone oscillator for one clock period, producing a dit. If three addresses in a row are turned on, the tone oscillator will be turned on for three clock periods, producing a dah. The space between dits and dahs of the same letter is equal to the length of one dit. The space between letters of the same word is three dits (one dah), and the space between words is six dits (two dahs). For example, to store a W in memory takes nine addresses (Table 1). Since address zero is on and address one is off, the tone oscillator will be on for one clock period and off for one clock pulse, thus forming a dit. Addresses two, three, and four are on and address five is off, so the tone oscillator will be on for three clock periods and off for one, thus forming a dah. Table 2 shows the address locations to send CQ DE.

I would suggest that you program the first five or so addresses as zeros. This will give a slight delay from the time the generator is started until the code starts rolling out. In a repeater, this delay

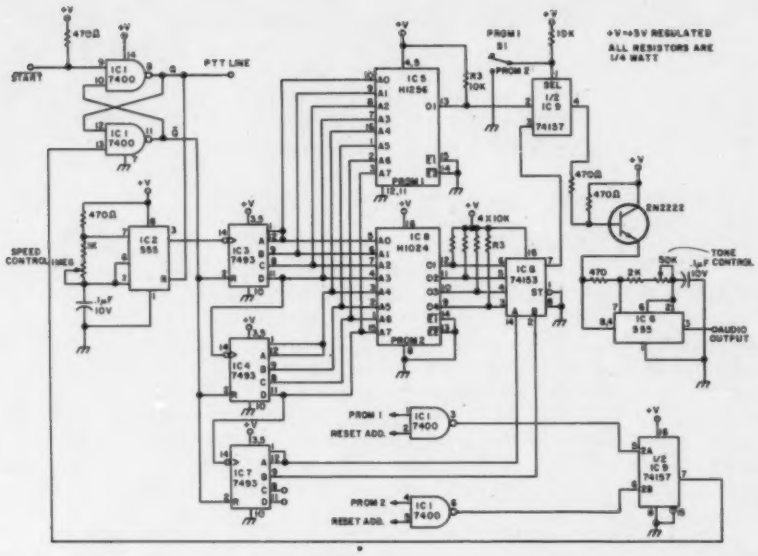

Fig. 5. A combination of Fig. 2 and Fig. 4. This circuit features adjustable speed, adjustable tone, and selection of two PROMs. Switch S1 selects PROM 1 or PROM 2. Each PROM has a separate reset address. The PROM pinout for PROM 1 is a Harris 1256. PROM 2 is a Harris 1024. I use PROM 1 to send my call and PROM 2 to send my name and address.

will give the transmitter time to come up, eliminating the possibility of chopping off the first part of the first letter sent. This is a matter of personal choice. If you do not want a delay or have a very long message to send, start your first letter at address one. Address zero must have a zero programmed in it. This address is selected when the identifier is in the reset condition and a one here will cause the tone oscillator to be on constantly. If you use this circuit as a RTTY generator, this will cause a mark tone to be sent while the generator is in the reset mode. If you do not want the mark tone sent during reset, use the alternate circuit of Fig. 3.

Selecting a PROM

Of all the PROMs on the surplus market, the 32 x 8 is probably the most common. This PROM is good for use as an automatic telephone dialer, but as a simple CW ID generator it requires too much extra circuitry (although an adaptation of Fig. 4 could be used). A 256 x 1 PROM is more than enough for sending your call and QTH. If you have a long message or several different messages to send, a 256 x 4 or 512 x 4 can be used. A 256 x 4 has a total of 1024 bits of memory and a 512 x 4 has 2048 bits. A 256 x 4 is large enough to send my name, full address, and even the name of the company I work for.

If you obtain a PROM with more memory than you need, you don't have to program all the memory at one sitting. You might, at a later date, want to send something different and, by changing your counter circuit, or by using a different output of a multiple output PROM, you can program the unused addresses.

Expanding the Basic PROM Generator

Fig. 4 shows a modified Fig. 2. The circuit has been modified to use a larger PROM (more outputs). The start, clock, and tone generator circuits are identical to the basic generator circuit. Now, however, instead of using a single output PROM, I am using a four output PROM. The 7493 binary counters count and address the PROM as before, but a new counter has been added so that when clock count 256 occurs, the PROM address is back at zero and pin 12 of IC7 goes high, causing the second output of the PROM to be connected to the tone generator through IC8. IC8, a 74153, can be thought of as a four position electronic rotary switch; the position of the switch is selected by IC7. On clock count 512, the PROM address is back at zero again and output three is tied to the tone generator. Likewise at address 768; output four is tied to the tone generator and the PROM is at address zero again. This scheme allows sending 1024 bits of data in an unbroken stream. Resetting is done as before by decoding the reset address line with a NAND gate and taking the reset line of the start flip-flop low.

RTTY Message Generator

To build a RTTY message generator you can use either the circuit of Fig. 2 or that of Fig. 4. Every RTTY character consists of seven parts: a 22 ms start pulse, five 22 ms data pulses, and a 31 ms stop pulse. The total time for a 60 wpm RTTY character is the sum of these pulses, which is 163 ms. By adjusting the period of IC2 to 11 ms and letting two addresses represent the stop pulse, a RTTY character can be sent in 165 ms. Because with this timing the stop pulse is 2 ms longer than normal, the generator will be sending at about 1% slower than 60 wpm. I doubt that you will be able to see any difference. The longer stop pulse does not affect the TTY timing because if no character is sent, the machine

Address	Output state	Represents:
0	1	space tone (start)
1	1	space tone (start)
2	1	space tone (data)
3	1	space tone (data)
4	0	mark tone (data)
5	0	mark tone (data)
6	1	space tone (data)
7	1	space tone (data)
8	0	mark tone (data)
9	0	mark tone (data)
10	1	space tone (data)
11	1	space tone (data)
12	0	mark tone (stop)
13	0	mark tone (stop)
14	0	mark tone (stop)

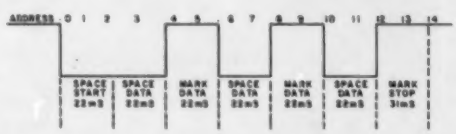
ADDRESS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
SPACE START 22mS
SPACE DATA 22mS
MARK DATA 22mS
SPACE DATA 22mS
MARK DATA 22mS
SPACE DATA 22mS
MARK STOP 31mS

Table 3. Address locations and memory content to send the RTTY character R. Note that each RTTY character requires fifteen addresses.

Configuration	Bits	Maximum no. of RTTY characters
32 x 8	256	17
256 x 1	256	17
64 x 8	512	34
256 x 4	1024	68
512 x 4	2048	136
512 x 8	4096	273

Fig. 4. An expanded identifier. This circuit features adjustable speed, adjustable tone, and up to 1024 bits of memory. The PROM pinout is for a Harris 1024, 256 x 4 PROM.

sees a constant stop signal. Either the two-tone generator of Fig. 3 can be used or you can use your own AFSK oscillator. Table 3 gives a programming truth table for sending a RTTY R. As you will notice, because every RTTY character is of the same fixed length, it will take fifteen addresses to send a RTTY character. There is no need for spacing between characters due to the existing start and stop pulses. Table 4 shows the maximum number of characters you can store in some of the available PROMs.

Construction

The layout and wiring for these circuits is not critical. All voltage lines should be bypassed where the lines enter the board and at several points on the board, directly at the Vcc pins of the ICs. If you plan on using this circuit as a repeater identifier, shielding the whole circuit board may be necessary to keep rf from triggering the circuit or causing the counters to count extra counts.

I have built one of the identifiers using wire wrap and two using circuit stick. I would suggest that unless you like the messy job of making printed circuit boards, you use circuit stick. Circuit stick is adhesive-backed copper patterns that are used with predrilled boards. Patterns are available for all kinds of circuit elements. I also suggest that you use sockets for the ICs. The extra cost of the IC socket will be forgiven the first time you have to unsolder a soldered-in IC. Fig. 5 shows the layout I used for the two circuit stick boards. Wire wrap is great if you can afford the cost of the wrap gun and wire wrap board. For the ham interested in only an occasional circuit board, I don't suggest you invest in a wire wrap outfit.

Fig. 6. This is the layout of the circuit in Fig. 2 when using circuit stick.

Conclusion

The most obvious use for this circuit is as a repeater identifier. But because of the versatility of the PROM, this circuit can have hundreds of uses. Some examples are:

For the repeater – automatically dialing police and fire phone numbers in following with the 911 plan; automatically bringing up the repeater and sending an alert message in the case of someone breaking into the repeater site.

For the ham shack – an automatic station identifier; automatic CQ caller; automatically send QSL information; touchtone frequently dialed telephone numbers.

For the RTTY station – all of the above plus as an RY generator, the quick brown fox generator, and to store RTTY pictures. ■

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Would you believe that you can build your own portable semi-solid state minicomputer, take it to an FCC examination, and use it with the inspector's blessing? You may think there is some catch to this, but your curiosity is aroused. Or perhaps you think, "Code's a cinch, so who needs it?" Well, let's just listen up here around 50.4 MHz for a minute.

> "Yeah, Al, I went down to the candy company a couple of times to try for the General, but I finally decided that this class of license is nothing to be ashamed of. We got it pretty good here on six meters. It's not crowded. In fact, the band really needs the activity. We're performing a public service, the way I look at it. Anyway, cee-dubble-yew isn't really like talking to somebody. The low bands are way too crowded now with all those sidewinders squawking away on top of each other down there. Yes sir, six is the only band where you can still have a good old-fashioned QSO any more."

Now let's read the mail on the repeaters. Sounds like the gang on 16/76 is heatedly discussing mobile rig rip-offs. Gee, what happened? Bill just asked Stan if he had worked any of that hot DX on twenty meters last night and nearly everyone destinated or got a land line all of a sudden. Aw, come on, why would they be embarrassed?

OK, I admit it. I was one of those dudes until about a year ago when I rediscovered *73 Magazine*. Wow, there was a bright new world out there! Wayne Green had built a bridge which made international Morse code at 13 wpm attainable. I could stop pretending I was as real a ham as those others. That inspired the experiments which led to Codebuster. You can build a similar system, and there's no reason why it can't take you on to 20 wpm and the Biggie if that's what you really want. I wasn't kidding about Codebuster. This is actually a construction article, so let's get started.

A black box of any convenient size will be appropriate for housing the unit. Just think of it – that black box with its sophisticated microcircuitry smoothly converting audio input into video and graphic output. When properly programmed, the speed of translation is limited only by the physical response time of the graphics drive. Now that wasn't hard, was it?

Nikola Tesla, it is told, designed his ac motors and generators by carefully assembling scale models in his mind. When they were later built, the real prototypes were found to perform in every respect as Tesla had imagined they would. Even the patterns of wear on the moving parts had been predicted.

It is apparent that each of us has a built-in bioelectronic microprocessor of fabulous capability. Each second it performs routinely feats of information processing and retrieval unequalled by the largest solid state machines. Some of its input channels haven't even been identified yet. What we've done is to dedicate one tiny partition of it to serve temporarily as our black box. Building Codebuster is a snap. Now all we have to do is program it properly.

Operating as designed in its normal state, our master computer should be as capable as any physical device of executing flawlessly and instantaneously any desired function. We simply feed in a lookup table of sound equivalents for the various characters and we're in business. Dit dah is A, dah dit dit is B, and so forth. Did I hear you say that it isn't that simple?

All right, why not? There are two reasons, basically. One is scattered attention. The input data gets mixed with so many thousands of bits of other data each second that our computer gets confused. The other reason is the existence of many levels of previous programming, much

of it contradictory. This is called conditioning, and unfortunately most of the documentation for it is not readily available. That makes debugging something of a challenge at times. But despite all this, it's not difficult to prove that the inherent functional capability is there.

Experimentally, normal subjects like you and I have been asked to watch a passenger train as it roars through a suburban station in a featureless blur of motion. Later when their minds were properly relaxed, they could recall in complete detail what was seen in each window of the passing train. Features of the passengers, their hair and clothing, could all be accurately described. Verification was provided by comparison with slow motion movies or independent accounts of other observers. Explain this however you will, our minds can be shown to possess fantastic capability when allowed to perform as designed. Obviously there's no problem with the computer itself. It is the programming and output that will make our Codebuster function properly.

Although we began a small debugging operation earlier in the article, it will be necessary to go much farther. Let's have a look at that old program. Who told you that code was hard? When did you decide that you'd never be able to copy 13 (or 20) words per minute? How many times can you remember saying, "I hate code"? Are these attitudes of any help to you now? Perhaps the time has come to put that old program out to pasture and replace it with a new one.

Code is very much alive. Most resistance to it appears to stem simply from unfamiliarity with it. You could begin to think about its advantages and usefulness. Thumb through a copy of the Callbook some time. It is fat with the names of thousands of hams throughout the world who have used and enjoyed CW. Listen to CW on the ham bands or commercial transmissions on a general coverage receiver. Nobody makes any of those people use that mode of communication. So whether you intend to use code or not, deliberately reprogram your attitude toward it. And know, deeply and firmly, that what hundreds of thousands of others have done, you can do – and will!

Any successful endeavor requires first of all a clearly defined goal. We need to visualize exactly what we want to accomplish. And secondly, we must generate and maintain a strong desire to reach that goal. We can't just pretend that we want to learn code. If hangups or attitudes of self-depreciation stand in the way, we want to recognize and change them. There are new methods, new tools, new FCC examinations, and we need a positive and confident attitude to go with them. You want to be able to send and receive 13 or 20 words per minute so bad that you can taste it. Good, that's the operating system for the Codebuster. Keep it that way.

If you have ever had any kind of amateur license, you were able to send and receive at least 5 words per minute. That may be an asset. But you could have learned code at that speed by sight. Those little tables of letters followed by dots and dashes are murder. If you never studied one, thank your lucky stars. We want to establish an automatic motor response to an audio signal – not translate the sound for each character through some visual delay circuit. A is simply the sound dit dah, nothing more. Hear it, write it. This way we place no artificial limitation on the speed of comprehension and your Codebuster will function as it should from the beginning.

Many years ago, an old-time railroad telegrapher confided to me the secret of his expertise. "It's easy," he said. "I just read a stream of beautiful purple characters which passes across my mind's eye like a tape." He had created a Codebuster in his mind and it did all the work for him. He programmed his computer creatively in a way that was efficient and esthetically pleasing to him. Now purple letters may not appeal to you. You may prefer direct graphic output via the old pencil. But you may find that some form of visualization helps you to concentrate, at least in the beginning. So experiment with it if you like.

Since you're going to be copying code at 13 wpm, it makes sense to use instructional material in which components of the characters are spaced at that speed. This avoids having to relearn the code at each successively higher speed. It is a good idea to review from the beginning anyway, since most people have neglected numbers and punctuation. For this reason, an investment in the 73 code tapes, including the 5 wpm learning tape, is very worthwhile. If you think that this new system is only Wayne Green's advertising gimmick, perish the thought. It's the biggest advance in learning code since Morse invented it. It even worked for me!

Have you considered the optimum form of output for your Codebuster? Please, seriously consider writing the characters. Printing is quite difficult for most people at 13 wpm and next to impossible at 20. On the other hand, ordinary handwriting is smooth and easy even at 25 wpm. You will never regret learning to write code and the FCC could care less. They won't even read your copy under the new system. So why place an unnecessary limitation on the graphic response time of your machine?

The first sessions will be fun. In a relaxed way, build your mental table of sound equivalents and write the characters as you listen to them. Soon you'll move on to the 6 wpm tape and be copying code groups, at least some of them, pretty well. But code groups don't seem to be much fun. Thirteen wpm still sounds like white noise to you – all you can make out is a period now and then. And you just heard Joe calling QRZ on the repeater. Hold on there – the voltage on your ICs is dropping. We'd better check the power supply.

You know that it takes voltage and current flowing in a circuit to produce power. If our resistance is too high, nothing can be accomplished. So whenever we detect resistance rising, we must increase the voltage and reduce the resistance. We need, in other words, both a clearly defined goal and a powerful incentive to reach it. Remembering these principles can save us a lot of sweat and tears. The primary challenge for most people studying code, aside from arranging regular study periods, seems to lie in this area. You can grit your teeth, get out the old horsewhip and do it the hard way, or you can do it the easy way and enjoy it.

Code study will become a habit in a surprisingly short time if you make a regular time for it each day. Many people find it convenient right after the evening code practice transmission of W1AW. Practice less often than every other day may make the road a long one for you. Once you begin to copy smoothly at any speed, you should find the period pleasant in that it mobilizes enough attention to relax your mind. But to get back to that power supply, let's consider some ways that you can crank up your voltage and decrease your resistance.

Why not arrange some activities that you enjoy to serve as rewards? Listen to some SSB on the low bands, for instance, and frankly admit to yourself how much you would like to talk to

those hams. Thumb through the ads in *73* and drool over some new gear. Picture your dream shack in your mind. You're sitting there working a beautiful YL (or a handsome OM, if you are a YL) in some exotic QTH halfway around the world — or maybe in the next town. "U HAVE A NICE FIST BUT PSE QRS," you copy. Don't laugh. You've got to psych yourself up a little. After all, if you don't, who will? So invent some incentives.

One ham who finally made General after a real struggle at an age when most people wouldn't have tried is fond of telling newcomers, "If you want that ticket bad enough, you'll get it!" Well put, Mac. Wanting it badly enough is indeed the secret. So want it. Want it so bad you can taste it. And keep on wanting it while you prepare to get it. Isn't that easier than a negative, half-hearted approach which may get lost in the QRM halfway through the schedule? Start saving for that low band rig. Plan the antennas you'll put up. Dream a little — or a lot — but engineer it to stimulate rather than distract from your code practice.

OK, we've gotten over the first barrier and have progressed right along. Straight text at a challenging speed has been alternated with code groups and reversed text. You can copy most of what you hear in the Novice band, and isn't it swell that the Techs can finally get in there and increase their code speed with on-the-air practice? Or can they?

Let's be honest with ourselves now. Increasing proficiency requires challenge. Do you deliberately work someone who is too fast for you, or are you embarrassed to ask for repeats? "SORRY, BAD QRM OM, 73." And consider the format of a typical Novice QSO. Everything but the handle and address identical each time, and those are sent three times at about four words per minute. You could work stations that are comfortable for you to copy for years without increasing your speed at all. So it will take regular schedules with practice material being sent at higher speeds and regular sessions with your tapes to do the job. It's great that you enjoy CW QSOs, but use them as a reward after a solid study session instead of a delusion.

Now you're copying 10 solid, and 80% or so at 13 wpm. But in the last two weeks it doesn't seem that you've made much progress. In fact, some nights you are actually worse, and you're getting discouraged. Is it that dreaded plateau you've heard about? Don't worry. That used to happen with the old methods of studying code when it had to be relearned at each higher speed. But characters built with 13 wpm spacing circumvent this difficulty. Let's keep up the incentives while we troubleshoot the problem.

Is your practice challenging but not exhausting? Do you always follow it with some pleasant activity as a reward? It might precede your nightly QSO with John on six meters, or a TV program you are fond of watching. Or maybe it's that cold 807 and a bedtime snack that you look forward to. This kind of human engineering will help you over the rough spots. Don't force practice to the point where you build up more resistance than you can handle. Analyze the problem. You're only going to have to copy five minutes of code for the test. The length of time you can copy without strain will increase along with your proficiency. Stop and relax whenever you feel yourself tensing up. Take some deep breaths. Try to keep it pleasant.

Your progress may not be even. With most people it's not. There are some procedures you can try if it seems slow. Listen to very fast code as though it were music, code at a speed much faster than you can begin to copy. Pretty soon you will start to recognize a character here and there. Some people begin each session with a few minutes of fast code even though they can copy only 20 or 30% of it. Then when actual practice is started, it sounds very slow and leisurely by contrast.

Think code whenever you can, at least several times a day. Read license plates or street signs into code while driving to the salt mine in the morning. What would the menu sound like in code at lunch? Relate code to things you do each day so that it becomes part of your life rather than some minor extraneous activity. And visualize yourself, particularly just before you go to sleep, easily and enjoyably copying code at your desired speed. This need take only a few seconds, but it does a great job of programming Codebuster at a subconscious level.

Now we are ready to make the final push, to surmount the last barrier. To do this, we will employ fast code as a diagnostic tool. A warning here — this will cause you to memorize and render worthless as practice material whatever you use. Therefore work with only a short portion of your code group tape at 14 wpm, or better yet some other similar material. Do the best you can to copy it. Then listen to this section over again as many times as necessary to correct your errors of omission and commission, noting each one. You'll probably find, as I did, that only a few characters are giving you all the trouble. When you hit one of these and aren't certain of it, you hesitate to think about it and then skip several succeeding characters. Once these troublemakers are identified, you can work on them specifically. In a short time, you'll be copying code consistently at a much higher speed.

Each person has some individual hangups on certain characters. I had difficulty telling B from D and H from S. Many people find 7 and 8 confusing, or 2 and 3. Characters such as Z or Y are less often used in straight text, so they are practiced less. Code groups which use each character with the same frequency overcome this liability. Once you have identified your particular stumbling blocks, spend about half of your practice time working exclusively on them.

Now don't tell me you can't stand to listen to your own sending. After all, other people will have to listen to it, including the examiner. You know that speech is improved by feedback in sales training and speech therapy. The same method will improve your code sending. You will need a chance to listen carefully to these particular characters and analyze them so that you can tell them apart. The only way to do this is to break out your key and record them on tape. Begin at a speed which you can ordinarily copy. Since these characters are probably the same ones you were having trouble sending, you'll bag two birds with the same stone.

If it is H and S which you find confusing, send H H H H S S S S. Repeat each character you find difficult several times to afford ample opportunity to study it, and group confusing characters together. Copy this tape for several days, until you are thoroughly bored with it. Then mix all these characters up on a new tape at a slightly higher speed. Work on this one until you have them all down pat. Increase the speed again, adding other characters that might be similar to them. Construct code groups in which at least half of the characters consist of those still giving you trouble. You can repeat the diagnostic process to identify these as necessary.

As you send and listen to them, note the relationship between the characters in the following groups:

A R L AS AR
N D X /
S V 3 SK
A U V 4
M G Q ,
T M O 8
H 4
A W P
T N D B 6 -
E I S H 5
N K Y
G Z 7 ,
A W J 1
P X Y Q
I U F / 2
, ?
N K C .
R L U F

Using this approach, analyzing your hangups and making specific study tapes to overcome them, your improvement will be fast and continuous. If you are working with a buddy, so much the better. You can send each other this type of material.

By now you copy all characters equally well and your code speed is really up there, but the problem is consistency. You can copy half a minute or so perfectly but then something happens and you miss several words. Or you can find yourself writing *modulator* when the word being sent turns out to be *modulation*. The name of this game is anticipation, and it can be a problem indeed. The mind tries to avoid effort by guessing from the context what is coming next. When that turns out to be wrong, confusion results and characters are missed until the copy can be picked up again. Trying to correct the missed copy only makes things worse. You are reading the message instead of copying the code. Your job is to disconnect the analytical process temporarily and let your Codebuster produce copy automatically.

During World War II, Algerians were trained to copy code in English although they did not understand the language. This is the process which must occur in your mind initially. Comprehension while receiving will develop later on as the process becomes an automatic response. It is like being able to talk to someone while driving a car. At this point, comprehension is not the objective. You can always read your copy later. Since anticipation is a serious liability with straight text, work with code groups or reversed text to overcome it.

If you are able to receive W1AW, their daily code transmission can furnish you with good practice if a few lids stay off the frequency. All too occasionally they send text in which the order of the words is reversed. This is far superior to straight text for practice and easier to take than code groups. Tapes of such material can be used several times, in contrast to straight text. So if you can, get someone to send you reversed text. Make your own tapes if you have to. But stay away from copying straight text until you have whipped anticipating.

Since anticipation is a process of thought, we can devise methods to prevent it. Some people find it helpful to keep their attention focused on a blank screen in their mind. When a letter is completed, it appears there and they copy it. Or you might try to become aware of the stimulus-response process as it occurs. Instead of focusing your eyes on your copy, direct your attention internally to Codebuster wherever you feel it is located. With your eyes unfocused you can still write a straight line on the paper, but can't read it. Like the operators in Algeria, you are not concerned with its meaning at that time. You hear it and you write it.

Learn to maintain an intense state of detached curiosity about the next character you are going to hear. Be willing for it to be whatever it will be. Simply let it be written effortlessly and instantaneously as soon as it is complete. No thoughts distract your attention. If you miss a character, just let it pass and wait placidly for the next one. You are, for the moment, The Codebuster, efficiently transforming audio signals into graphic output. Once you get the hang of this, believe it or not you will actually enjoy copying code. Then as your proficiency increases and the process becomes fully automatic, you will find yourself understanding what you are receiving without anticipating it.

At this point you've almost got it made. Straight copy at 15 wpm is a breeze and you're ready for the code test. Or are you? Let's not kid ourselves at this stage of the game. In the first place, the FCC will not send you cream-puff straight text like you get from W1AW. And you won't be in your quiet familiar room. You'll be in a large, strange room listening to a tone higher or lower than you prefer from a speaker at some distance from you, probably a little nervous and surrounded by other people. Have you given yourself any practice under such conditions? Your actual code speed is not what you can copy with easy material occasionally under ideal conditions. It is what you can copy with difficult material consistently under somewhat adverse conditions. So take your recorder with you on trips and practice in a motel. Copy code at work during your lunch break. Vary the BFO note frequently. Turn on the TV or radio in the background. Check your speed when you're tired or upset, and with other people around. You will know whether you're ready or not.

Many people have fallen into the trap of having memorized their practice material. You may have recorded a large collection of tapes and used them only infrequently, but your computer never forgets. At a subconscious level you are familiar with material you have only heard once. Don't fool yourself into thinking that you are better than you are. You are just as good as you can copy new, unfamiliar material. Even reversed text becomes familiar after several hearings, so don't neglect the code groups. They are your insurance and the ultimate test of your ability.

Make sure you can copy material sent at several speeds. A number of people who could copy 15 or even 18 wpm solidly were unpleasantly surprised to find that they were very inconsistent at 13 wpm. The less challenging slower speed gave their minds time to anticipate. So while the fastest progress seems to be made practicing with material at a speed high enough to be quite challenging but not discouraging, it is a good idea to spend part of your time working at the speed at which you will be examined.

So it's back to the code groups for the last push. When you can copy that 14 wpm tape consistently under less than ideal conditions, then you are really ready, and not before. Of course, the experience of taking the code test can be valuable if your location is convenient. You're not even out $4 now if you don't make it. On the other hand, it can be discouraging to fail in public. You know your own reactions and will have to weigh the pros and cons for yourself.

Speaking of examinations, how do you feel about that? If just thinking about it makes you apprehensive, you need some practice. The next time you prepare to copy 5 minutes at 13 wpm, imagine yourself taking the FCC exam. Feel how important it is that you pass. Although you have been programming yourself to copy code in a relaxed manner, an occasional session which is deliberately mocked up in this way will prevent nervousness on the big day. Others around you will be nervous and that can be catching. So practice "taking the code test." Get someone else to time you. And when you no longer feel tense in this situation, you

will be cool, calm and collected during the real examination.

With comprehension testing for code receiving proficiency scheduled to be adopted by the FCC in 1977, your goal should be somewhat closer. Although designed to permit rapid grading of code tests by machine or template, the new examination will be easier on applicants who miss an occasional letter. No more will 65 successive error-free characters be the criterion for passing, but 16 out of 20 correct answers to TRUE/FALSE questions based upon the material sent in five minutes. Numbers, of course, will continue to be crucial.

What can you expect when you take the new code test? In the past, a disaster or accident of some type has often been the subject, liberally sprinkled with figures such as latitude and longitude, dates and times. Descriptions of equipment and distances might appear. The story may be interrupted with Q signals or an abrupt change in subject, as though a transmission were suddenly subject to QSB or QRM. You can assume that you will encounter the question mark and slant bar as well as the usual periods and commas.

You will be allowed to copy five minutes of code at the speed being tested and can then refer to your paper to answer the true or false questions which will subsequently be distributed. The usual practice of sending one minute of code for tone and volume adjustment can be used for warmup. You may be able to deduce a word even though some characters are missed, but copying numbers wrong will be more serious. Expect the questions to be paraphrased from the text. An example? Supposing you copy, "The transmitter is located 29 feet from the antenna." A question might be, "The antenna is located 28 feet from the transmitter." You would mark the answer FALSE.

Knowing what to expect will foster a calm and confident attitude conducive to good performance. But there's one last bit of programming that remains to be done. The Examiner! How do you visualize this individual? Is your mental image that of a terrible ogre, all-powerful, breathing fire while laser beams shoot from his eyes, gleefully chortling as he fails one hapless applicant after another?

Let's do something about this right now. Of course you can expect the examiner to be efficient and unbiased, but altogether human. He'll probably be courteous and hopeful that everyone is prepared to pass. Consider that he is there to help you, to make it possible for you to achieve that goal of a higher class of license. And it is your taxes that pay for it all. The image of the steely-eyed government inspector may sell Wayne's 14 wpm tape, but it won't do much for your sweaty palms. So expect to see a human being just doing his job, and that's what you will find. And when it's all over, he may even seem like a pretty nice guy. Mine was. After he said, "Congratulations, you've passed," I told him that he didn't look very steely-eyed. He smiled and said, "We're trying to change our image."

By communicating those techniques which have proven most helpful to some people, it is hoped that the path may be made a bit smoother for others. Certainly no special expertise is pretended. Each individual must find through experiment what works best for him or her in building their Codebuster.

To those fellow hams who shared, knowingly and unknowingly, their travails and triumphs, I express sincere thanks. And to those readers who are inspired to challenge the paper tiger whose name is Thirteen, good luck and Godcodespeed. See you on the low bands. ■

LETTERS

from page 61

"THANK YOU"

I have seen many letters in *73* which mentioned the number and quality of construction projects. The writers, however, fail to mention how much of the material for those projects is available from *73* advertisers. In the Holiday issue, I counted 17 suppliers of components for "home brew" projects. This does not include kits and parts of systems (Robot, Seals, Pala for instance). I believe this is more than the other 3 magazines combined (I get all 4 ham magazines, but have not counted).

Another big plus is the arrangement of the advertising. It *is* something of interest to the average reader, and so you distribute it among the articles. In turning from one article to another, it is easy to stop and see just what this ad is about. When advertisers are pushed to the back (the usual place), very few people will bother to look them up.

One policy you have which merits a big "thank you" is that of putting all of each article together. This probably helps more with construction articles than it would (for instance) with fiction, as the reader will find more need for referring to "the first paragraph" or "Fig. 1."

At times I do not agree with your editorial opinion, but at least you do express it. I doubt whether you would agree with me.

One more little thing I would like to mention. CB operators have been cussed and discussed a lot. I wonder how many hams ever stop to think – the CBers do the same thing we do. They get on the air and follow the example of others.

Thanks for letting me unburden myself.

Lester W. Ulch WB4HPB
Birmingham AL

WHAT HAPPENED?

One comment, if you please. Early in November was the ARRL Hudson Division Convention. I didn't go (I can't afford that kind of hamfest); however, I heard that it cost $4.00 to get into the flea market! The buyers paid the $4.00 (I have no idea what the sellers paid; I hate to think of it). Personally, I don't think *any* hamfest is worth paying $4.00 to get into. Maybe that's one reason so many people are going CB instead of ham. Who wants to pay that much for a get-together when they get into CB fests free? (I understand hamfests used to be that way – what happened?)

Bob Billson WA2TXY
Westfield NJ

P.S. I sent a similar letter to *QST*. I'm curious to see if they'll print it – hi!

Hey, Bob, it's a nonprofit organization, right? – Ed.

MILWAUKEE WINTER

In your Holiday, 1976 issue is an article by Scott Smith, entitled, "$22 for a Regulator? Never." Probably by now his car has failed to start in the Milwaukee winter.

First, he mentions that the alternator should put out 13.6 to 13.8 volts. This would hardly allow enough charge for summer, let alone winter. Typical voltages, these for a 240Z, range from 14.25 at 104 degrees to 15.00 at 14 degrees Fahrenheit. This brings up a second consideration – temperature corrections. As zeners have positive temperature coefficients, Scott's regulator will reduce voltage with lowering temperatures.

So far as the circuit goes, *neither* transistor is operating as a switch as the author says (*try* that with an emitter follower sometime). Also, the field can never get full voltage as needed for low speed charging. An average field is about 4 Ohms, an average 2N3055 has a gain of about 40, yielding a field voltage of about 8 volts *maximum*! Commercial solid state regulators use PNP pass transistors, which can be put into a saturating configuration.

David S. Powell WA4BRI
Lexington KY

MA BELL – AGAIN

I had one heck of a noise burst forth on the low end of 160. It sounded like LORAN, but didn't synchronize with any of the local LORAN transmitters on either 2 MHz or 100 kHz. It was a 60 cycle buzz, changing now and then to 120 cycles.

I tried to find it, without success, on the power lines; finally had it reappear when I approached the telephone lines. Using a hand-held broadcast radio, it showed a fairly large standing wave on the phone lines. Investigation with a wideband receiver showed its fundamental frequency to be about 900 kHz. No trace on 450 kHz.

I went to the nearest telephone

Continued on page 111

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True FM

Careful attention to the transmitter audio circuitry and the use of true FM gives exceptional audio quality. A Schmitt-trigger squelch circuit with a threshold 0.3 μV or less provides positive, clearly-defined squelch action. Other design advantages include diode-protected dual-gate MOS FET's in the front end, IC IF and dual-conversion receiver.

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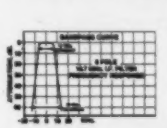
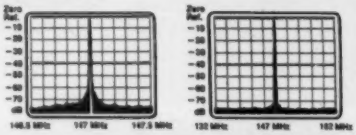


An 8-pole IF crystal filter greatly reduces adjacent channel interference.



Actual spectrum analyzer photos of the HW-2036 transmitter output operating at 147 MHz. Spurs within 30 MHz of carrier are down a full 70 dB!

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How Counter ICs Work

-- the next step is a micro

In the past 2 to 3 years, projects that have been coming out of ham shacks across the nation have undergone some dramatic changes.

One of the reasons for this is that integrated circuits of increasing complexity have become available at a price that makes it practical for more and more amateurs and experimenters to build with them. And when amateurs start to build, fascinating things can happen: digital clocks, frequency counters, frequency synthesizers, microcomputers and much, much more.

One of the ICs that is used in many of these projects is the counter chip. It is the counter chip that I am going to be looking at in this article and you will see that it can do more than just count.

Let's start by going into one of the more popular counters, the 7490. This IC is made up of four flip-flops which are internally connected in such a way that the IC can divide by 2 or divide by 5 and, by making an external connection, can divide by 10, or count pulse inputs and give a BCD coded output.

The flip-flops also have a clear and preset which are connected through 2 input NAND gates. The clear and preset are called Reset "0" and Reset "9", as they put the counter in the BCD output condition of "count 0" or "count 9" respectively.

A diagram and pinout of the 7490 are shown in Fig. 1.

To use the 7490 in divide-by-two operation, put the input on the "A" input (pin 14) and take the divided output off the "A" output (pin 12).

To use the IC in divide-by-five operation, put the input on the "BD" input (pin 1) and take the divided output off the "D" output (pin 11).

Notice that the two divide operations are separate inside the IC, so the 7490 can be used as a divide-by-two and as a divide-by-five section at the same time, using a common clear and preset.

For the divide-by-ten operation, both of the divide sections are used. First the signal is divided by five, then fed into the divide-by-two section. To connect the IC for this, connect the "D" output to the "A" input. Input pulses applied to the "BD" input (pin 1) will appear divided by ten at the "A" output (pin 12).

Count	Output			
	D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Fig. 2. BCD output count sequence.

To use the 7490 in its normal mode of operation as a decade counter with BCD output, the "A" output (pin 12) is connected to the "BD" input (pin 1). The pulses to be counted are applied to the "A" input (pin 14) and the output count will appear as BCD code on the "A", "B", "C", and "D" outputs (pins 12, 9, 8, and 11).

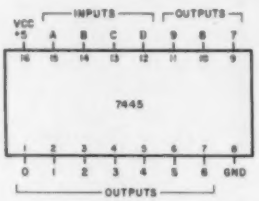

Fig. 3. Pinout of 7445.

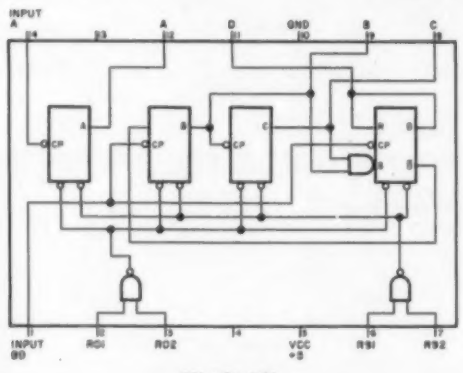

Fig. 1. Diagram and pinout of 7490.

Inputs				Outputs									
D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

Fig. 4. 7445 truth table.

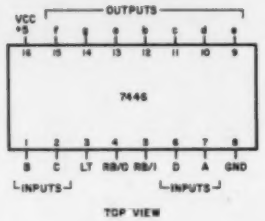

Fig. 5. Pinout of 7446.

Inputs						Outputs								
LT	RBI	D	C	B	A	a	b	c	d	e	f	g	RBO	Function
0	X	X	X	X	X	0	0	0	0	0	0	0	1	Test
1	0	0	0	0	0	1	1	1	1	1	1	1	0	Blank
1	1	0	0	0	0	0	0	0	0	0	0	1	1	0
1	X	0	0	0	1	1	0	0	1	1	1	1	1	1
1	X	0	0	1	0	0	0	1	0	0	1	0	1	2
1	X	0	0	1	1	0	0	0	0	1	1	0	1	3
1	X	0	1	0	0	1	0	0	1	1	0	0	1	4
1	X	0	1	0	1	0	1	0	0	1	0	0	1	5
1	X	0	1	1	0	1	1	0	0	0	0	0	1	6
1	X	0	1	1	1	0	0	0	1	1	1	1	1	7
1	X	1	0	0	0	0	0	0	0	0	0	0	1	8
1	X	1	0	0	1	0	0	0	1	1	0	0	1	9
1	X	1	0	1	0	1	1	1	0	1	0	1	1	10
1	X	1	0	1	1	1	1	0	0	1	1	0	1	11
1	X	1	1	0	0	1	0	1	1	1	0	0	1	12
1	X	1	1	0	1	0	1	1	0	0	0	1	1	13
1	X	1	1	1	0	1	1	1	0	0	0	0	1	14
1	X	1	1	1	1	1	1	1	1	1	1	1	1	15

Fig. 6. 7446 truth table.

The BCD output count sequence is shown in Fig. 2.

In some circuits we may be able to use the output as is. That is, in the BCD format. In other circuits, we may need to decode the BCD to decimal form. This may be done with a decoder such as the 7445 decoder/driver which will take the BCD code as it is input and give an output in a decimal form.

A pinout of the 7445 and its truth table are shown in Figs. 3 and 4.

In other circuits, a seven-segment code may be needed to operate one of the seven-segment displays. A decoder such as the 7446 or 7447 BCD to seven-segment decoder/driver may be used.

A pinout of the 7446 and its truth table are shown in Figs. 5 and 6.

In most circuits using the 7490, it will be necessary to reset the counter to either "9" or "0" at certain times. To reset to the BCD count of zero, both reset "0" inputs must be at logic "1", while at least one of the reset "9" inputs is at logic "0". To reset to the BCD count of nine, both of the reset "9" inputs must be at logic "1", while at least one of the reset "0" inputs is at logic "0".

For proper counting, at least one of the reset "0" inputs and at least one of the reset "9" inputs must be at logic "0". Counting of the 7490 will occur on the negative-going edge of the input pulse. That is when the pulse goes from high to low. See Fig. 7.

Fig. 7.

A second counter IC is the 7492 divide-by-12 counter. It is similar to the 7490, but the second section is connected internally to divide by six and there is no reset to "9", only a reset to "0".

A diagram and pinout of the 7492 are shown in Fig. 8.

With no external connections, an input at "A" (pin 14) will give an output divided by two at the "A" output (pin 12). An input at the BC input (pin 1) will give an output divided by six at the "D" output (pin 8) or divided by three at the "C" output (pin 9).

For the divide-by-twelve operation, output "A" is connected to the "BC" input – an input at the "A" input will then give you a division by twelve at the "D" output.

To reset the 7492 to BCD count of zero, both reset "0" inputs must be at logic 1. At least one of the resets must be at logic 0 for proper counting. Like the 7490, the 7492 counting occurs on the negative-going edge of the input pulse.

Another counter which is similar to the 7490 is the 7493 4-bit binary counter, which can count to 16 or divide by 2, by 4, by 8, and by 16.

The diagram and pinout of the 7493 are shown in Fig. 9.

With no external connection, an input at "A" (pin 14) will give an output divided by 2 at the "A" output (pin 12). An input on the "B" input (pin 1) will give an output divided by 2 at output "B" (pin 9), divided by 4 at output "C" (pin 8), and divided by 8 at output "D" (pin 11).

For the divide-by-16 operation, output "A" is connected to the "B" input. An input at the "A" input will then give you a division by 16 at the "D" output.

To reset the 7493 to count zero, both reset "0" inputs must be at logic 1. At least one of the resets must be at logic "0" for proper counting. Counting will occur on the negative-going edge of the input pulse.

The 74176 is a divide-by-2, divide-by-5 or divide-by-10 counter with an added feature over the other counters we have looked at. It has the ability of strobed parallel entry. This lets the counter be "programmed," and also lets it be used as a 4-bit latch.

The 74176's diagram and pinout are shown in Fig. 10.

To use this IC as divide-by-2 or divide-by-5, no external interconnections are required. The strobe (pin 1) and the reset (pin 13) are held at logic 1. An input signal at input Cp1 (pin 8) will give an output divided by 2 at output Qc (pin 2). An input at Cp2 (pin 6) will give an output divided by 5 at output Qd (pin 12).

For use as divide-by-10, connect the D input (pin 11) to the Cp1 input (pin 8). A clock input signal at Cp2 (pin 6) will give an output divided by 10 at the Qa output (pin 5). As in the divide-by-2 and 5 operation, when used as divide-by-10, the strobe and the reset are held high.

To use the 74176 as a

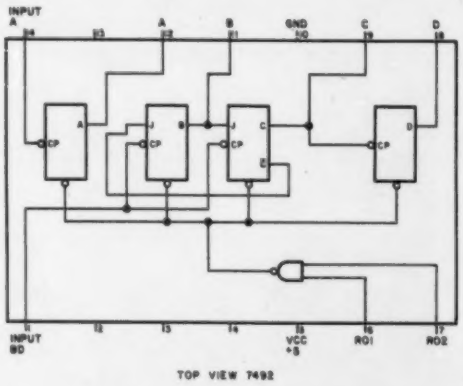

Fig. 8. Diagram and pinout of 7492.

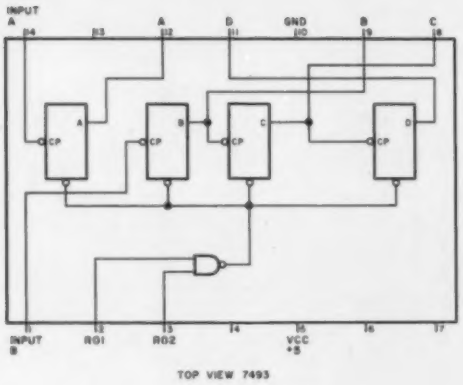

Fig. 9. Diagram and pinout of 7493.

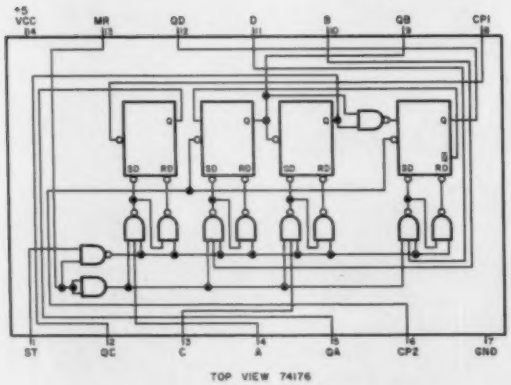

Fig. 10. Diagram and pinout of 74176.

counter, the Qa output (pin 5) is connected to the Cp2 input (pin 6). The input is applied to the Cp1 input (pin 8) and the count is obtained at outputs Qa, Qb, Qc, and Qd (pins 5, 9, 2 and 12). The reset (pin 13) is used to reset the counter to BCD count "0". Put high for counting and low to reset.

The strobe input is used for the parallel entry feature of the 74176. When the strobe (pin 1) is high, inputs A, B, C, and D (pins 4, 10, 3 and 11) have no effect on the outputs. When the strobe is put low, the outputs will change to agree with the data inputs independent of the state of the clock inputs. This feature will allow the IC to be "programmed" or preset to any count, not just "0".

The parallel entry will also allow use of the 74176 as a 4-bit latch. The data outputs Qa, Qb, Qc, and Qd will directly follow the inputs A, B, C, and D while the strobe is low, but will remain unchanged when the strobe is high and the clock inputs are inactive.

The counters that have been discussed here are only a small sample of the ones that are available. With counter ICs, as with simple gates, the best way to find out just how they work is to use them. All ICs listed in this article are available for under one dollar from advertisers in *73 Magazine*, so pick out one or two and start experimenting and then start building. ■

References

The TTL Data Book for Design Engineers, Texas Instruments Incorporated, 1973.

Digital Integrated Circuits, National Semiconductor Corporation, 1974.

The TTL Applications Handbook, Fairchild Semiconductor, 1973.

TS-1 MICROMINIATURE ENCODER-DECODER

- ☐ Available in all EIA standard tones 67.0Hz-203.5Hz
- ☐ Microminiature in size, 1.25x2.0x.65" high
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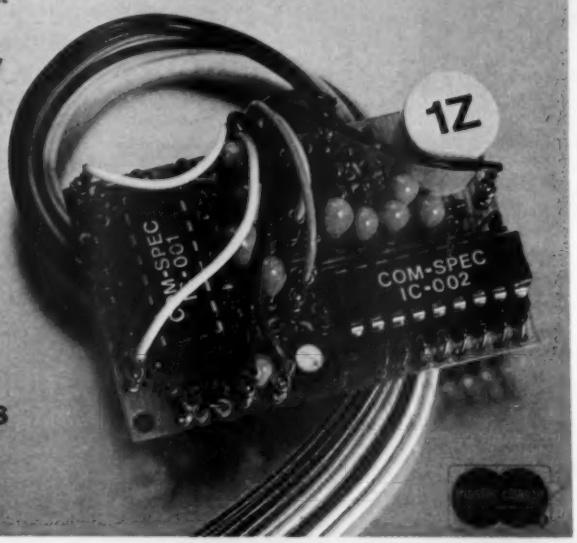

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3 7 digit display, resolution 100Hz with 10m Sec. gate interval, pre-scaled! 10Hz resolution with 1 Sec. pre-scaled, 1Hz resolution with 10 Sec. gate interval pre-scaled!

4 Built-in 5VDC regulator; input to 3-terminal regulator is accessible for use with 12VDC out-board PS. You can use this counter mobile.

5 Easy 6 hour assembly; all circuit broad tracks are pre-tinned, have drilled holes and are plated through! All I.C. sockets included - Makes trouble shooting a breeze.

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Front view showing layout of voltmeters, variac, control, S1, S2, and fuses. The handles are very functional because of the weight of the unit.

Charles O. Klawitter W9VZR
4627 North Bartlett Avenue
Milwaukee WI 53211

Inexpensive Variable DC Supply

- - easy and quick

It is extremely handy to have a source of variable dc energy in the ham shack. The usefulness of this device encompasses many areas. For instance, many of today's projects are built around semiconductors which require various dc voltages. Much of the military surplus available requires either 12 V dc or 24 V dc sources. You may not want your final conversion to operate on this source, but it can be very helpful to see if the equipment will function on its original source voltage before converting it. Those people active as mobilers certainly could use a husky supply to test that new mobile rig. Obviously, anything that is battery operated could be run, tested, or repaired with the help of this electronic wonder. It might even help you start your car some cold winter morning.

As you can see from the schematic, it is simply a variable autotransformer feeding a husky 30 V transformer into a bridge rectifier. The filter is a large capacitor. It would be nice to have a 30 A choke, but the filter shown has been satisfactory for all of the uses previously discussed.

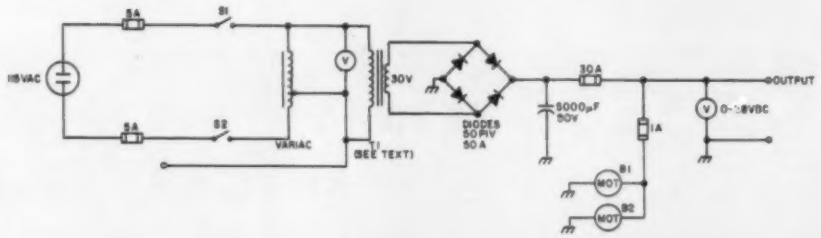
Well, now that I have established two major facts, its simplicity and its usefulness, let's build it.

You may skip this part of the article if you have a transformer or are going to purchase one. The transformer for this unit was a modified TV transformer. I located the heaviest one in the junk box. By the way, this was my first attempt at rewinding a transformer, and if I can do it, you probably can also.

First remove the outer shell and the laminations. It may be necessary to use a little force to accomplish this. Never hit the laminations directly with a hammer; use a mallet or a block of wood with your hammer. Take care to preserve the leads from the windings.

Next, remove the secondary windings. Generally they are the outer windings. When you remove the 6.3 V filament winding, count the number of turns. It probably will consist of approximately twelve turns. Usually this type of transformer has a two turns per volt ratio. Retain this information for rewinding the secondary.

Finally, rewind the secondary; I used number 12 copper wire with a thick thermoplastic insulation. I used this wire because I had it

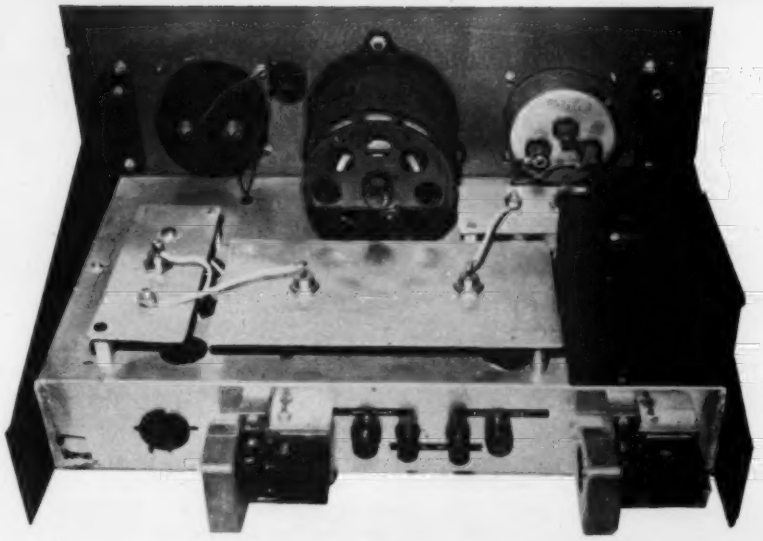


left over from wiring my wife's dryer. Obviously, an enamel or formvar insulated wire is suitable. As you are winding the secondary, check to be sure that the laminations will fit. I was able to get about sixty turns on the secondary – hence thirty volts. Using wire with thinner insulation, you can probably get several more turns.

The diodes were surplus units which were mounted on homemade heat sinks. The heat sinks were made from 1/8" thick aluminum scrap. I used about 12 square inches for each diode. The heat sinks were mounted on one inch ceramic pillars above the chassis to promote convection. Several holes were drilled in the chassis below the heat sinks; there was a bottom plate attached and two small 24 V dc surplus blowers were mounted on the back of the chassis. The output of the power supply was used to power the blowers. Even at five volts input, the blowers would move some air. The blowers really aren't necessary until the supply is run at high current output over a five to ten minute period of time.

The toggle switch, S2, which removes the variac from the transformer and places the line voltage there instead, is used when there is a load which will greatly surpass the rating of the variac.

This unit has been used for everything from repairing transistor radios to operating dynamotor powered mobile equipment of the 12 V, 30 A variety. ■



Rear view showing general layout of diodes and heat sinks, output and blower fusing, blowers, and line input.

LETTERS

from page 104

exchange, about 7 miles away at Belfair, Wa., and circled the building with a $4 BC receiver. It was easy to find the spots on the walls where the noise peaked. Local phone company employees blamed the trouble on the power people, refusing to believe that any phone equipment could cause radio interference. They were so insistent in their belief that they didn't report interference to local headquarters in Seattle. They finally told me to tell it to FCC.

FCC contacted Seattle engineering. After some days I called engineering, and they said they would do something about it. It has been 5 weeks of passing the buck, and until intervention by FCC, there was no action at all. They will tell you anything, but do nothing.

The trouble finally turned out to be the battery charger at the exchange office. They haven't fixed it yet, and I have notified them that my hobby involves circulation of audio currents through widely separated grounds.

So, in the case of a pulse type noise, or a sharp rattling noise, particularly on 160 meters, check your phone line for the source. It is to be hoped that the management of your telephone exchange will be more cooperative than the locals. I don't know if the chargers used by General Telephone subsidiaries cause the same type of interference.

Keith Olson W7FS
Belfair WA

SPLENDID SERVICE

About 4 months ago I wrote you and complained about the very bad postal service and very late delivery of the *73 Magazine*.

I don't know how you are doing it or what you have done, but I now receive your excellent magazine for 3 months in succession the first week of the current month the magazine comes out. To beat everything, I received the December issue at the end of November. Needless to say, I want to thank you and your staff very much for this splendid service.

I received this subscription to your magazine from my good friend Ed Dombert W2PCP, and this is a very valued present. Living on this island "down south of you," it is annoying how long it sometimes takes to receive the mail from up north. Here again, you beat the others, and once again, thank you and well done.

William Vander Greft PJ2WI
Curacao, Neth. Antilles

SANDY CLAWS

I received the sample copy of *73* today which I had requested some time ago when your subscription offer came.

Looks like you do have a pretty good magazine. However, it sure let me down the very first thing. You see, I have been taking another magazine for several months just to get the ad section, because I want a good used SSB/CW rig. So, right off the bat, I went to the back of *73* and searched all the way to the front. Then from the front all the way to the back. Plenty of good-looking new stuff. But if I give around $700 for something to play with, I think it should also cook my breakfast! So the answer is a good $400 used outfit.

I certainly appreciate this opportunity to see what *73* is like and after my other subscription expires and I get a new rig, perhaps I'll try it. With tax time here and the usual rough time with Santa Claus just over, things are pretty rugged, even in Dixie. (If inflation gets much worse, Sandy Claws may find himself going down the drain instead of the chimney.)

Jim Miller
Waterloo SC

THE BROAD SPECTRUM

This note is to inform you that I have been very pleased by the excellent service and response of your advertisers, namely Ramsey Electronics, James Electronics, and many others.

I might also add that your many construction articles are very FB and your publication covers the broad spectrum of amateur radio very well.

Alex Hallman W2OEQ
Woodhaven NY

29.6

I read Martin Greenbaum's article "Ten Meters: Dead or Alive?" with great interest. However, there was a gross oversight in his article, especially with the great interest there is today in FM. 29.6 MHz has for years been the FM channel on ten meters, and you haven't worked DX until you've worked someone full-quieting 3000 miles away, or worked your next-door neighbor through a repeater 3000 miles away. With the low cost avail-

Continued on page 172

Form 765 Provisional. Number 14120

LICENSE FOR GENERAL (General or restricted) AMATEUR RADIO STATION

DEPARTMENT OF COMMERCE
BUREAU OF NAVIGATION
RADIO SERVICE

Pursuant to the act to regulate radio communication, approved August 13, 1912, E. G. Schalkhausser, a citizen of the State of Nebraska, having applied therefor, is hereby granted by the Secretary of Commerce, for a period of one year, on and subject to the restrictions and conditions hereinafter stated and revocable for cause by him, this License to use or operate the apparatus for radio communication (identified in the Schedule hereinafter) for the purpose of transmitting private radiograms or signals, notwithstanding the effect thereof extends beyond the jurisdiction of the State or Territory in which the said station is located: Provided, That no interference other than may result under the restrictions contained in this License shall be caused with the radio communication of stations of the Government of the United States or licensed stations.

2. The use or operation of apparatus for radio communication pursuant to this License shall be subject also to the articles and regulations established by the International Radiotelegraphic Convention, ratified by the Senate of the United States and caused to be made public by the President, and shall be subject also to such regulations as may be established from time to time by authority of subsequent acts and treaties of the United States.

3. The apparatus shall at all times while in use and operation be in charge of a person or persons licensed for that purpose by the Secretary of Commerce, and the operator of the apparatus shall not wilfully or maliciously interfere with any other radio communication.

4. The station shall give absolute priority to signals or radiograms relating to ships in distress; shall cease all sending on hearing a distress signal; and shall refrain from sending until all the signals and radiograms relating thereto are completed.

5. The station shall use the minimum amount of energy necessary to carry out any communication desired, and the transformer input shall not exceed ~~one-half~~ one kilowatt.*

6. The station shall not use a transmitting wave length exceeding 200 meters.

7. The station shall not use a transmitter during the first 15 minutes of each hour, local standard time, whenever the Secretary of Commerce by notice in writing shall require it to observe a division of the time, pursuant to the Twelfth Regulation of the act of August 13, 1912.

8. The President of the United States in time of war or public peril or disaster is authorized by law to close the station and cause the removal therefrom of all radio apparatus, or may authorize the use or control of the station or apparatus by any department of the Government upon just compensation to the owners.

9. The Secretary of Commerce and Collectors of Customs or other officers of the Government authorized by him may at all reasonable times enter upon the station for the purpose of inspecting and may inspect any apparatus for radio communication of such station and the operation and operators of such apparatus.

10. The apparatus shall not be altered or modified in respect of any of the particulars mentioned in the following Schedule except with the approval of a radio inspector, or other duly authorized officer of the Government.

11—4000

*Strike out "one" if the station be within 5 nautical miles of a naval or military station; otherwise strike out "one-half."

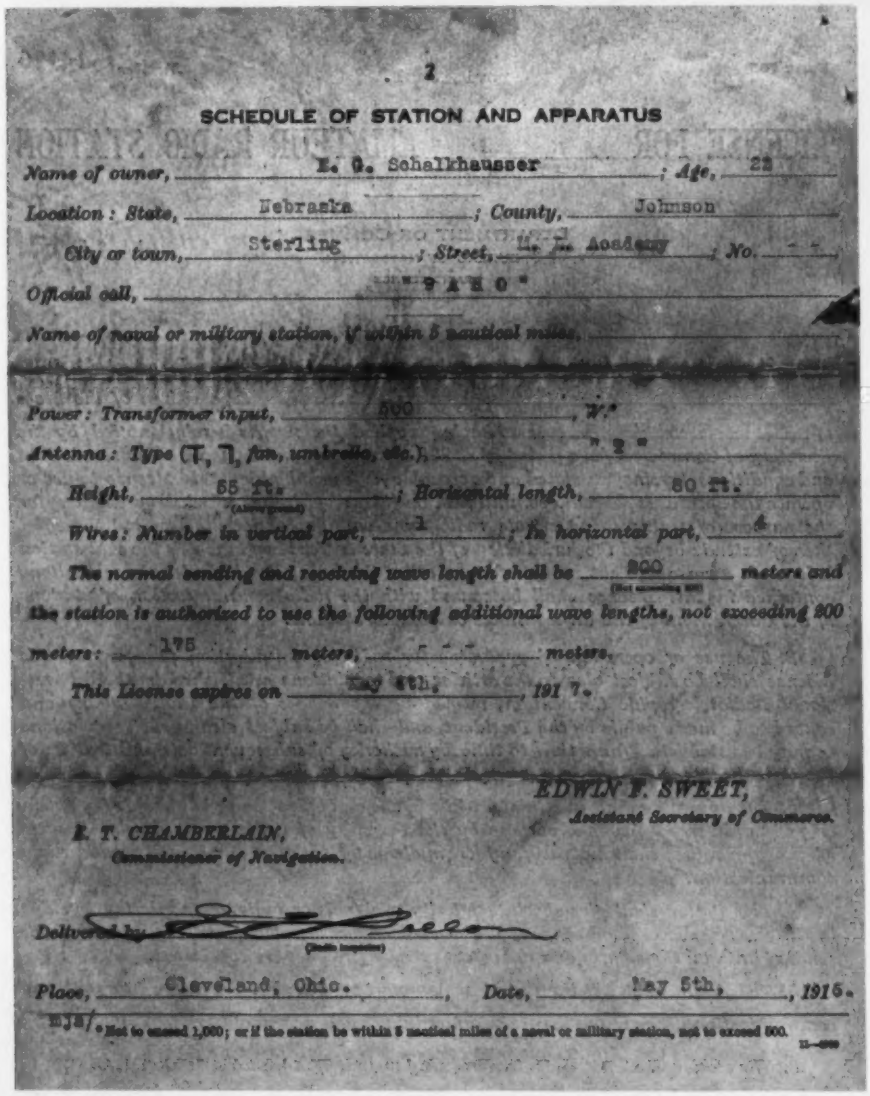
Eric G. Shalkhauser W9CI
527 Spring Creek Road
Washington IL 61571

One of the first amateur licenses issued shortly after they were required.

The History of Ham Radio

- - part I

When trying to get just a glimpse of wireless history in a nutshell, it is traditional to lay most emphasis on the years from 1910 and on. This period coincided with radio rules and regulations, the three Rs, being formulated by the United States government. We then project the general accumulation as far as 1927-1928, after which time some degree of order was again established in the radio industry, overall.



2

SCHEDULE OF STATION AND APPARATUS

Name of owner, E. G. Schalkhausser ; Age, 22

Location: State, Nebraska ; County, Johnson

City or town, Sterling ; Street, H. S. Academy ; No. - -

Official call, "9 A H O"

Name of naval or military station, if within 5 nautical miles,

Power: Transformer input, 500 W.

Antenna: Type (T, L, fan, umbrella, etc.), "T"

Height, 55 Ft. (Above ground) ; Horizontal length, 80 Ft.

Wires: Number in vertical part, 1 ; In horizontal part, 4

The normal sending and receiving wave length shall be 200 (Not exceeding 600) meters and the station is authorized to use the following additional wave lengths, not exceeding 200 meters: 175 meters, - - - meters.

This License expires on May 6th, 191 7.

EDWIN F. SWEET,
Assistant Secretary of Commerce.

E. T. CHAMBERLAIN,
Commissioner of Navigation.

Delivered by (Radio Inspector)

Place, Cleveland, Ohio. Date, May 5th, 1916.

EJS/ Not to exceed 1,000; or if the station be within 5 nautical miles of a naval or military station, not to exceed 500.

In telling our story, it is impossible to refrain making pertinent insertions of interest. There were many occurrences during those early years that stand out vividly in memory and need telling. Those beginning years were mostly of pioneering and exploring, bringing forth many discoveries and inventions in rapid order, in very short periods of time.

1909

To begin with, let me set the year 1909 as a reference. Why 1909? We will become aware of the reason as we review the history in relating the *magic that is wireless.*

And it sure was magic to everyone in those days, believe me! Let me take a short glimpse into the past history of wireless. There were no laws on the books. There were no rules or regulations pertaining to wireless. The general public was not even aware that radio waves existed. They had no inkling of what was meant by communicating without wires. Practically nothing was known about electricity. All this was a mystery.

1888

In 1888, just 89 years ago, a German Scientist made a discovery when he sensed

that there was something present in the vicinity of an electrical spark in a Lyden jar discharge. This elementary discovery made by Heinrich Hertz set the stage for many scientific investigations. They were carried on in university laboratories, stimulating research in the field of electromagnetic waves.

1892

About this time, along came Marconi from Italy. He was born in the year 1874. At the age of 18, while a freshman at the University of Bologna, Marconi discovered that an electric discharge from a condenser could be detected. This made possible the transmission and reception of signals over some distance. Playing around and experimenting for four years, he finally went to England, where he demonstrated his findings and equipment.

1896

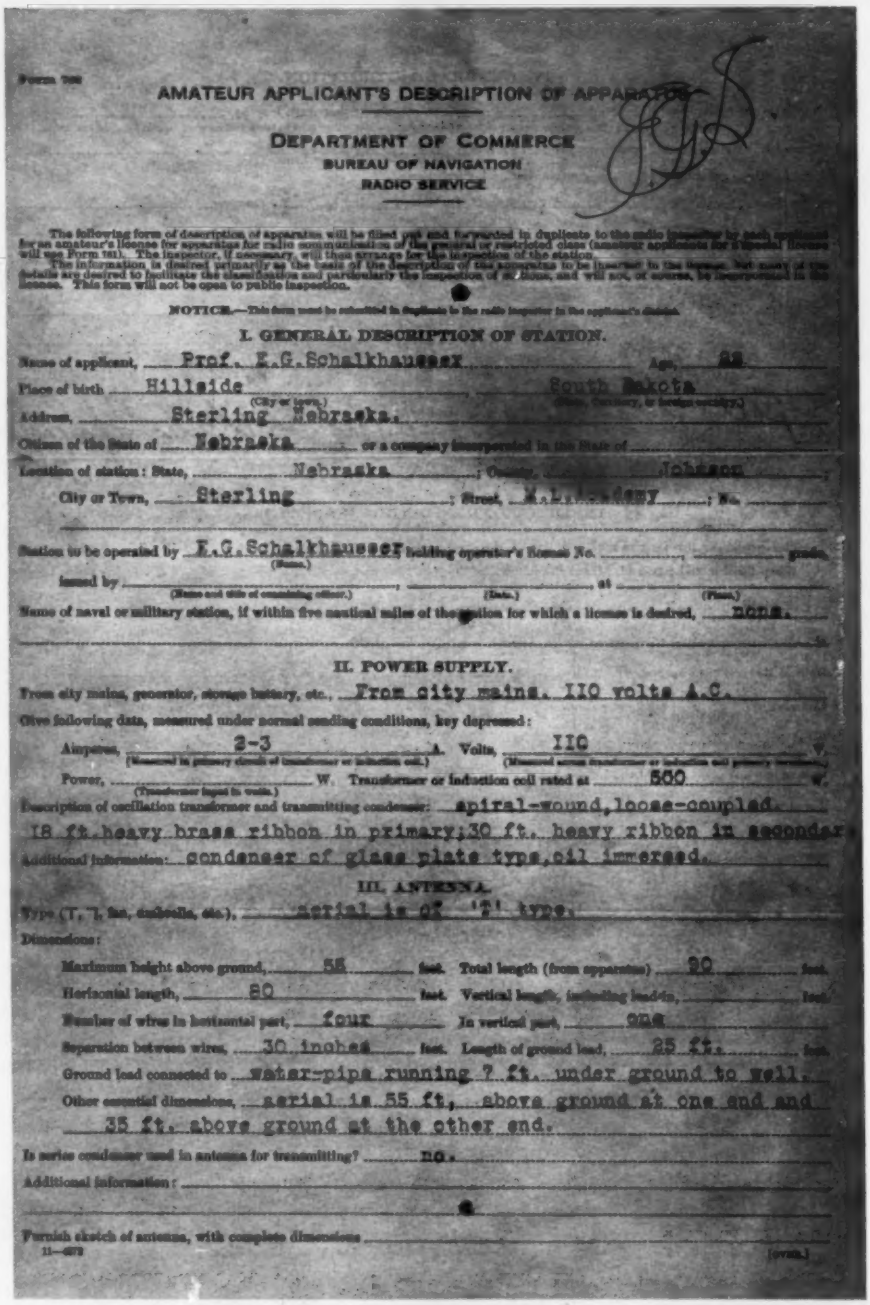
In 1896, Marconi obtained a British patent for *wireless telegraph apparatus using electricity*. How utterly novel and primitive that description sounds today. And that was only eighty-one years ago! (At that time I was 3 years old, but do not recall the incident!)

1897

Within a year, commercial interests became aware of the possibilities in the application and use of Marconi's invention and organized the Wireless Telegraph and Signal Company, Ltd., in England.

1899

In 1899, Marconi and his assistants succeeded in sending signals across the English channel with their crude equipment. The main bottleneck was their iron filing coherer for detection of signals. The use of galena, silicon, or carborundum was not yet known for detecting wireless signals. In this same year, the Marconi Wireless Company of America was established.



Form 705

AMATEUR APPLICANT'S DESCRIPTION OF APPARATUS

DEPARTMENT OF COMMERCE
BUREAU OF NAVIGATION
RADIO SERVICE

The following form of description of apparatus will be filled out and forwarded in duplicate to the radio inspector by each applicant for an amateur's license for apparatus for radio communication of the general or restricted class (amateur applicants for a special license will use Form 711). The inspector, if necessary, will then arrange for the inspection of the station.
The information is desired primarily as the basis of the description of the apparatus to be licensed, but many of the details are desired to facilitate the classification and particularly the inspection of the house, and will not, of course, be incorporated in the license. This form will not be open to public inspection.

NOTICE.—This form must be submitted in duplicate to the radio inspector in the applicant's district.

I. GENERAL DESCRIPTION OF STATION.

Name of applicant, Prof. E.G.Schalkhaeuser. Age, 22
Place of birth Hillside (City or town.) South Dakota (State, Territory, or foreign country.)
Address, Sterling Nebraska.
Citizen of the State of Nebraska or a company incorporated in the State of
Location of station: State, Nebraska; County, Johnson;
City or Town, Sterling; Street, Main academy; No.
Station to be operated by E.G.Schalkhaeuser (Name.) holding operator's license No. , grade,
issued by (Name and title of examining officer.); (Date.) at (Place.)
Name of naval or military station, if within five nautical miles of the station for which a license is desired, none.

II. POWER SUPPLY.

From city mains, generator, storage battery, etc., From city mains. 110 volts A.C.
Give following data, measured under normal sending conditions, key depressed:
Amperes, 2-3 (Measured in primary circuit of transformer or induction coil.) A. Volts, 110 (Measured across transformer or induction coil primary terminals.) V.
Power, (Transformer input in watts.) W. Transformer or induction coil rated at 500 W.
Description of oscillation transformer and transmitting condenser: spiral-wound, loose-coupled. 18 ft. heavy brass ribbon in primary; 30 ft. heavy ribbon in secondar
Additional information: condenser of glass plate type, oil immersed.

III. ANTENNA.

Type (T, L, fan, umbrella, etc.), aerial is of 'T' type.
Dimensions:
Maximum height above ground, 55 feet. Total length (from apparatus) 90 feet.
Horizontal length, 80 feet. Vertical length, including leading, feet.
Number of wires in horizontal part, four In vertical part, one
Separation between wires, 30 inches feet. Length of ground lead, 25 ft. feet.
Ground lead connected to water-pipe running 7 ft. under ground to well.
Other essential dimensions, aerial is 55 ft, above ground at one end and 35 ft. above ground at the other end.
Is series condenser used in antenna for transmitting? no.
Additional information:
Furnish sketch of antenna, with complete dimensions
11—672 [over.]

1900

At the turn of the century, the English company changed its name to Marconi Wireless Telegraph Company, Ltd., to be more in keeping with current developments.

1901

In 1901, Marconi and two of his engineers came across the Atlantic to set up their wireless equipment in Halifax, Newfoundland. They succeeded in receiving messages across the waters from a station transmitting out of Polduh, England. All this on very long wavelengths, since the shorter ones were still undiscovered. By this time, many ships at sea were installing transmitting and receiving equipment and many shore and inland locations established communication centers.

IV. GENERAL INFORMATION.

Normal wave length used in sending 300 meters. Other wave lengths, ... meters.

Normal day communicating range with similar station No power during day. ..... miles.

Stations with which communication is carried on:

No. 2701 O St. Street. Distance, 35840 mi. Owner, H.H. Smith

No. ..... Street. Distance, 10 Owner, Lyle Francis

No. ..... Street. Distance, ... Owner, ...

No. ..... Street. Distance, ... Owner, ...

Additional information: .....

April 20 1916 (Date submitted by applicant.) Jef G Schalkhauser

INSTRUCTIONS TO RADIO INSPECTORS.

Please send out this form in triplicate, one for the applicant's files, if he desires.

When filled in and returned, fill out the following:

Received by .....

at ..... Date, ...

Date of inspection (If inspected) .....

Licensed as {general / restricted} amateur station.

Serial No. .....

Date of issue, ...

Signature of Inspector, ...

The inspector will then retain a copy for his file, and forward the form to the Commissioner of Navigation, to whom the inspector should also submit a special report before issuing the license if he be in doubt on any matter concerning it.

An apparatus description, one of the required parts of getting an early ham ticket.

1902

By 1902, a great deal of interest was shown in the application of this relatively new phenomenon. Gradually, better detecting devices were invented and larger stations were erected, in Europe, America, and other countries.

The station of 9AHO.

One should call attention to the contributions made at this time by Sir J. J. Thompson, a British scientist, who had discovered the electron, enclosed in a vacuum tube. It was a sequel to Edison's invention of the light bulb.

1904 and 1906

This led to the development of the use of vacuum tubes in detecting wireless signals, where J. A. Fleming in 1904 and Lee DeForest in 1906 made their contributions. While the sagas of the sea kept the newspapers busy and the public talking of the great wonders of wireless and its possibilities, what do you suppose was going on among the younger scientists across the country, especially in the eastern part of our United States? All of these intriguing possibilities of radio did not just belong to commercial companies – *by no means!*

Here we digress a bit and look into the back rooms and woodsheds around the country, taking note of the enthusiasm and the influence that wireless had produced among the young. We need to find out what was going on in these areas, since this part of early wireless history is vital in following the progress of the new discovery.

1909

This brings me to the year 1909, previously referred to. While the commercial interests considered wireless in terms of their restricted domain, we find a group of "wireless kids" in New York, no more than ten in number, all in their teens, getting together and forming a Junior Wireless Club on January 2, 1909. They were putting together metal plates, wires, and iron filings, making their own coherers, winding coils and other paraphernalia, and succeeding in sending dots and dashes according to the Morse code, between their homes, from block to block, and even across miles. They were listening in to what was going on, hearing the mes-

JUNIOR WIRELESS CLUB, LTD.

EACH MEMBER MUST HAVE MADE HIS OWN STATION.

W. E. D. Stokes, Jr., Its President—Headquarters at the Ansonia Contains Much Apparatus—Club to Go to Washington to Oppose Pending Bill.

It is somewhat dangerous to attempt to enter the clubroom and experimental station of the Junior Wireless Club, Ltd., without a guide, for the officer in charge dispenses with the necessity of lock and key by having the knob charged with electricity to give the unexpected—and unexpecting—visitor what he terms a "nice little shock."

But when proper guidance is secured from the club's young president, who maintains headquarters at his home, the Ansonia, many marvels and intricacies may be observed with some degree of security. W. E. D. Stokes, Jr., president, aged 14 years, points out the pitfalls.

"Look out. Don't step on that wire plate!" says he. "It's charged!" And you look out and don't step.

The clubroom and receiving station is imposing, almost formidable despite its somewhat small extent. In addition to the wireless telephone instruments at one side of the windows, the sending station across the way and the aerials connecting with three conduits above form the little room into an Aladdin cave of brilliancy.

"I'm always looking around at bulbs," says the president, "and when I see a new kind I try it."

So there they are, long and slim, short, fat and round, but all shining and bringing out dazzlingly the blueprints of scientific aspect which adorn one side of the wall, posters of the Postal Telegraph and Cable Company variety, illuminated letter placards bearing such legends as "No Smoking," "S. W. Co."—Stokes Wireless Company—and last but not least printed lists of wireless signal stations and steamers with wireless equipment.

These steamers and signal stations are all intimately acquainted with the experimental station of the Junior Club—too much so at times, it seems, when the Manhattan Beach station has to ask it to stop receiving for a time, for the Manhattan Beach station is less powerful and is retarded in receiving.

The young president puts the receiving headgear on your head.

"Listen," he says. "They're talking to Manhattan Beach."

"How can you read it?" you ask.

"Listen," he says. "The answer—da-da-da-da—don't you hear it?" And he becomes a trifle impatient at your stupidity. He discusses condensers, detectors, sensitive points and other appropriate topics for your enlightenment, but you are a poor subject.

Then the president tells how the Junior Wireless Club came to be, how it operates and what it intends.

About two years ago the Junior Aero Club, under the direction of Miss E. L. Todd, participated in the toy exhibition held at Madison Square Garden. Three of these youthful members, Frank King, Fairmote Munn and Frederick Seymour, specialized on wireless telegraphy and frequented Miss Todd's studio on West Twenty-third street to experiment. Each of them made his own wireless apparatus, and through the newspapers they invited any other boy to come and show a mechanical set he had made himself.

W. E. D. Stokes, Jr., then aged 12, had rigged up a wireless outfit which he brought forth to display and which Frank King helped him set up. Such books as the "A B C of Wireless Telegraphy" and "Electricity of Everyday Life" and possibly, the random assistance of a random electrician were the principal sources of information.

The father of W. E. D., Jr., met the boys and invited them to his home to form a club. There the Junior Wireless Club, Ltd., came into being with headquarters at the Ansonia, there being just enough offices to go around among the charter members. W. E. D. Stokes, Jr., was made president; George Ehle, 401 West Forty-seventh street, vice-president; Fairmote Munn, East Orange, N. J., recording secretary; Frank King, 370 East 149th street, corresponding secretary; Frederick Seymour, East Orange, N. J., treasurer. Miss E. L. Todd was made honorary president, Prof. R. A. Fessenden of Brant Rock, Mass., was chosen as consulting engineer, and Seymour, Seymour & McGrath, 71 Broadway, as general solicitors and patent attorneys. Thus from the start the club's letterheads presented a complete and dignified appearance and are as yet unchanged, although the club has extended its membership to thirteen.

At 10 A. M. the first Saturday of each month from October to May the club holds meetings at the Ansonia, goes through the regular preliminary business acts on the business letters received and the applications for membership, talks over schemes and, most of all, works with the wireless. The necessary qualification for membership is that the applicant has himself made his own wireless apparatus; later he may have assistance and more elaborate mechanical contrivances, but the first rule is inviolable.

They first memorize the Morse code until they are able to think in dots and

W. E. D. STOKES, JR., AND HIS WIRELESS TELEGRAPH.

This article appeared in a New York City newspaper early in 1910. The boy in the picture is the first president of the Junior Wireless Club, later renamed the Radio Club of America.

sages floating around between ships and shore stations. This was real fascination!

1910

Naturally there were bound to be conflicts developing, especially between the commercial companies and the "interlopers." Interference occurred and became objectionable for "the big boys." So in the following year, 1910, the existing problems were brought to the halls of Congress, to find ways and means to regulate wireless communication and define domains. True, the ether was free space and belonged to everybody, but the commercials and their interests sought to have vested right in their use of this "free" space. Thus, the conflict . . .

The conflict was brought to a head in the introduction of two bills, one in the House and one in the Senate. House bill #23495 and Senate bill #7243 were introduced. The senator strongly in favor of these bills was none other than Chancy Depew of New York, which was the bailiwick where the interlopers were operating. The contents of the bills were strongly against any use of the airways by anyone except the commercials. The teenagers with their homemade equipment and their determination, organization, and above all, their spirit, had other ideas. They wrote a letter to Chancy and told him so. Here we note something which will be of interest to all of you. The boys of the Junior Wireless Club had a meeting, selected their representatives, and asked to have a hearing in Washington. They composed another letter to Chancy Depew, were granted a hearing, and on April 28, 1910, were given the privilege of presenting their case. Believe it or not, these boys won their right to go on experimenting as they had done before. This Junior Wireless Club had performed like veterans in the halls of Congress, and to them and many others went the freedom of the ether for many years to come.

1911

So in 1911, the enthusiasm on the part of radio amateurs grew tremendously. In the same year, the Junior

Wireless Club changed its name to The Radio Club of America, and remains so to this day. The members became notables in wireless. The club was held in very high esteem, especially after their confrontation with Congress and their display of courage and dedication for a cause dear to their hearts and right in principle.

By 1911, every wireless company and operator on ship and shore knew that regulations were a necessity to hold down interference in radio communication. An Act, dated June 24, 1910, authorized by our Department of Commerce, Bureau of Navigation, became what at that time was considered the law of the land regarding radio transmission and reception. This Act consisted of four sections, all very general, and was labeled An Act to Require Apparatus and Operators for Radio Communication on Certain Ocean Steamers.

"Radio Apparatus"
presents a decided advancement in the production of instruments of quality for the transmission of intelligence without the use of wires. We extend our hearty congratulations to the members of the Association in their efforts to form an unbroken chain of Amateur Stations linking the various states, and will offer our willing support and assistance in any way possible in surmounting difficulties that may arise.
THE "RADIO ARLINGTON" $21.00
THE "RADIO SUPERIOR" $70.00
THE "RADIO INTERNATIONAL" $126.00
THE RADIO APPARATUS CO.
POTTSTOWN, PENN.

As soon as radio became popular as a hobby, equipment began appearing on the market. Note the flamboyant style of the copy, typical of the period. This ad appeared in 1915.

1912

On July 23, 1912 (two years later), and then only pertaining to section one of the four sections, the Act was amended, spelling out some specific details concerning operators and ships at sea. From then on, all transmitting stations would have to apply for a license to operate. The law was not too specific. It had loopholes, and many inland stations, especially amateur radio enthusiasts and experimenters, went about hooking up induction coils and going on the air with call letters assigned by themselves. For instance, a "one inch" spark coil was considered to be limited to no further than eight or ten miles, so did not fall within the law crossing state borders! What a "primitive" concept of wireless in those days. The type of signal coming from these amateur operated coils did not conform to any known bandwidth or frequency standard. A signal was "just a signal."

At this time, a number of wireless organizations blossomed. Notable among these were 1) The Institute of Radio Engineers, 2) The American Radio Relay League, and 3) The National Amateur Wireless Association. Up to this time there was very little literature or published information available. It did not take long for these to appear. Soon small companies issued store catalogs offering everything from loose couplers to crystals and crystal holders, headphones, and all sorts of gear to get the amateur started. Enthusiasm ran high. Wireless was a new found discovery and appealed to the young as well as to the old. Wireless could be used to span great distances and for so many experiments. The fascination of distant communication without wires was gripping and overwhelming.

National Amateur Wireless Association
This is to certify that
Prof. E. F. Schalkhauser
having furnished satisfactory credentials and having shown that he is a student of Radio Communication is hereby accepted in fellowship and full membership in THE NATIONAL AMATEUR WIRELESS ASSOCIATION of America. He agrees hereby as shown by his signature, to promote the interests of experimental radio work and at all times to observe the Laws of Radio Communication of the United States.
Signed by
Approved:
Executed by
Membership expires Jan 1917

Issued in January 1917, this certificate was one of the first of the "awards" that hams have always displayed with pride on the walls of the shack.

WHAT A GOVERNMENT LICENSE IS, AND HOW TO GET ONE

The law governing the operation of amateur stations was not passed with the idea of silencing the amateur operator—on the contrary, it is an official recognition of the amateur's rights—and a Government license carries with it advantages and privileges that otherwise the amateur would not enjoy—that is, if he keeps within the law. The law as it relates to the operation of amateur stations in itself is not a strict one. If you have a receiving station only, it is not necessary for you to get a license. If you operate a sending whose power is great enough to reach beyond the boundaries of the state you are located in, or to interfere with the licensed stations in the state, the law says you must have a license. Briefly, it states that your wave length shall not exceed 200 meters, and your transformer input shall not exceed 1 KW. Or if your station is located within five nautical miles of a military or naval station, your transformer input shall not exceed ½ KW.

The license is free, and the only requirements are, that you answer correctly the questions asked to the forms sent you, and that you are able to transmit and receive messages at the rate of at least 5 words a minute To get one, write the Radio Inspector, Department of Commerce, Bureau of Navigation of the District headquarters nearest you, and ask for Form 756, (Application for Operator's License) and Form 757 (Application for License for Land Station) both of which will be forwarded to you. If you have a license, Official Call Letters are assigned you which no one else can use. You know what you can do, and what you can't do, and no one can interfere with you in any way so long as you obey the law. For your own protection you should get one.

In 1915, the Central Radio Association issued its Blue Book, a reference text for early amateurs. It included this explanation of why licenses were required.

1914

Hiram Percy Maxin was one individual who could come up with the right ideas at the right time, and the ARRL was his heritage. No sooner had this enthusiasm caught fire when World War I broke out in Europe in 1914.

1917

The conflict went on for several years and sure enough, the United States became involved in 1917. All radio amateurs received notices to dismantle their equipment. Many joined the services in one capacity or other, many into the Signal Corps where their training and experience as radio operators was greatly appreciated by the government.

To be continued.

Jerrold Swank W8HXR
657 Willabar Drive
Washington Courthouse OH 43160

Remember the Windom!

- - is this the world's simplest five band antenna?

This antenna was one of the most popular antennas for amateur use, and it deserves more attention than it gets now, although it was first designed in 1929. In that year, two amateurs, John Byrne and Ed Brooke of Bell Telephone Laboratories, under the direction of Professor W. L. Everitt of the Department of Electrical Engineering, Ohio State University, experimented with and perfected this antenna. It was reported in September, 1929, *QST* by Loren G. Windom, and therefore became known as the Windom antenna.

Its chief advantage is that it may be used on all even harmonics with a single wire feed. Since amateur bands are harmonically related, except 15 meters, it may be used without change for an all band antenna. By cutting it for 80 meters, it can also be used on 40, 20 and 10, without changing the properly placed single wire feedline.

The length of the antenna is determined by the formula, 468/frequency in kHz. Thus, for 3725 kHz the length will be 125'8". The distance of the feeder from the center is approximately 14% of the antenna length, or about 17'6". At this point there are no standing waves on the feedline. By tapping the feeder up on the plate tank until the transmitter loads properly, you can tune for whatever band you are operating in. See Fig. 2. The feeder is #14 wire, any length.

To reduce the chance of getting rf in the station, the method in Fig. 2(b) can be used, with link coupling to an external tuned circuit. This antenna at the feedpoint has an impedance of approximately 600 Ohms.

There has recently emerged a similar appearing off center fed antenna which is incorrectly called a Windom, as shown in Fig. 3. The theory is that this is fed at a 300 Ohm point with twinlead, which can then be transferred by a 4-1 balun to 75 Ohm coax. There is some controversy about this, but at any rate the feedlines should come away from the antenna at a right angle for at least a quarter wave length, and the equipment should be well grounded to prevent floating rf in the station. ■

Fig. 1.

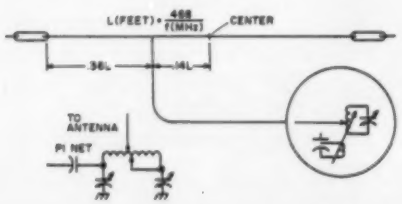


Fig. 2(a).

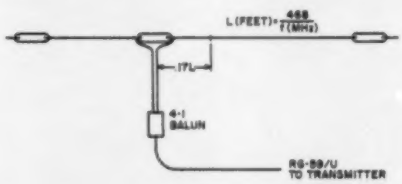


Fig. 2(b). *Fig. 3.*

SST T-1 RANDOM WIRE ANTENNA TUNER

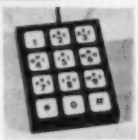
All band operation (160-10 meters) with most any random length wire. 200 Watt power capability. Ideal for portable or home operation. A must for Field Day. Size: 2 x 4-1/4 x 2-3/8. Built-in neon tune-up indicator. Guaranteed for 90 days. Compact — easy to use. Only $29.95.

ASTATIC MICROPHONES

T-UG8-D104, transistorized	$48.60
T-UG9-D104, "Golden Eagle," transistorized	$95.40
T-UG9-D104, "Silver Eagle," transistorized	$69.95
UG-D104, ceramic or crystal	$42.60

CES Touch Tone Pads — $49.95 ea. ● Model 200 — acoustic coupling ● Model 210 for mounting on walkies or handhelds

MODEL 200



MODEL 210

CES Model 220 CES can now offer you a TOUCH-TONE* back for Standard Communications hand held radios. This is the complete back assembly with the TOUCH-TONE* encoder mounted and ready to plug into the private channel connector. Also included is an LED tone generation indicator and an external tone deviation adjustment.

talk power by TPL

TPL for an Economy Price? THAT'S RIGHT! introducing the ECONO-LINE

Model	Input	Output	Typical	Frequency	Price
702	5-20W	50-90W	10 in/70 out	143-149 MHz	$139.00
702B	1-4W	50-90W	1 in/70 out	143-149 MHz	$169.00

Now get TPL COMMUNICATIONS quality and reliability at an economy price. The new Econo-Line gives you everything that you've come to expect from TPL at a real cost reduction. The latest mechanical and electronic construction techniques combine to make the Econo-Line your best amplifier value. Unique broad-band circuitry requires no tuning throughout the entire 2-meter band and adjacent MARS channels. See these great new additions to the TPL COMMUNICATIONS product line at your favorite amateur radio dealer.

For prices and specifications please write for our Amateur Products Summary! FCC type accepted power amplifiers also available. Please call or write for a copy of TPL's Commercial Products Summary.

SLINKY! $39.95 kit

A LOT of antenna in a LITTLE space New Slinky® dipole* with helical loading radiates a good signal at 1/10 wavelength long!

*patent No. 3,858,220

• This electrically small 80/75, 40, & 20 meter antenna operates at any length from 24 to 70 feet • no extra balun or transmatch needed • portable—erects & stores in minutes • small enough to fit in attic or apartment • full legal power • low SWR over complete 80/75, 40, & 20 meter bands • much lower atmospheric noise pickup than a vertical and needs no radials • kit includes a pair of specially-made 4-inch dia. by 4-inch long coils, containing 335 feet of radiating conductor, balun, 50 ft. RG58/U coax, PL259 connector, nylon rope & instruction manual • now in use by US Dept. of State, US Army, radio schools, plus thousands of hams the world over

Get on the air NOW! Let Tufts put you there!

by Standard Communications

Walkie Talkie 146 A

Horizon 2 25 Watts, 12 Channels

Penny Pincher 146A all XTALS (Specify three frequencies) $298.00

34/94 | 94/94 | | | |

SCOTCH TREAT SPECIAL as above includes rubber ducky antenna. Nicads with charger $335.00

34/94 | 94/94 | | | |

SCOTCH DELUXE as above plus Deluxe carrying case $349.00

THE WORKS: all channels your choice spare Nicad Battery pak $400.00

MOBILE DELIGHT — 6 channels your choice — Trunk lip or roof mount your choice $295.00

HORIZON 2 — 5/8 wave gain antenna

MOBILE DELIGHT DELUXE as above but all channels your choice $325.00

TUFTS

Radio Electronics

209 Mystic Avenue
Medford MA 02155
(617) 395-8280

New England's Friendliest Ham Store

Name _____ Call _____

Address _____

City _____ State _____ Zip _____

Order: _____

☐ Check enclosed

☐ BankAmericard ☐ MasterCharge ☐ American Express

Credit card # _____ Interbank # _____

Signature _____ Card expiration date _____

FREE Gift With Every Order!

ALL SALES FINAL !

MasterCharge American Express BankAmericard accepted on MOST items!

Prices FOB Medford MA. All units can be shipped UPS. MA residents add 5% sales tax. Orders over $1000 deduct 5%. Add $3.00 for shipping & handling on all orders.

TUFTS RADIO CATALOG TUFTS RADIO

HAM RADIO / MOBILE COMMUNICATIONS

THOMSON-CSF
NPC
ELECTRONICS

MODEL	NET PRICE		
12V4	$19.95	103R	$39.95
600	$20.50	*13 HM 4	$41.95
102	$24.95	104R	$49.95
612	$27.95	12/115	$69.95
107	$28.95	108R	$79.95
12 HM 4	$29.95	108RM	$99.95
		109R	$149.95

MODEL 12HM4

NPC 2.5 Amp Regulated Power Supply. Solid State. Short Circuit Protected.

Low cost regulated power supply quietly converts 115 volts AC to 13.5 volts DC ±200 millivolts. 1.5 amps continuous, 2.5 amps reg. Ideally suited for operating mobile CB transceivers in your home or office base station.

ALSO! Available as 13 HM 4 with built-in loudspeaker.

	TYPICAL	MAXIMUM
Output Voltage	13.5 ± .5VDC	14VDC
Continuous Current	1.5 Amp	
Regulation	2.5 Amp	
Ripple/Noise	5 mV RMS	10 mV RMS

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 107

NPC 4 Amp Power Supply, 6 Amp Max. Solid State. Overload Protected

Functions silently in converting 115 volts AC to 12 volts DC. 4 amps continuous, 6 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette player or car radio in a home or office.

Continuous Current (Full Load)	4 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	10,000 uF
Ripple (Full Load)	.5 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 5 lbs.

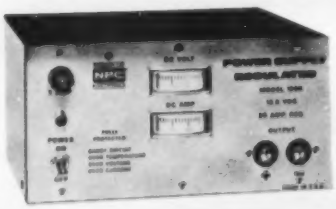
MODEL 103R

NPC 4 Amp Regulated Power Supply. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 2.5 amps continuous and 4 amps max. Ideally suited for applications where no hum and DC stability are important such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	2.5 Amp	
Current Limit	4 Amp	
Current Foldback	1 Amp	

Case: 3" (H) x 4¼" (W) x 5¼" (D). Shipping Weight: 4 lbs.



MODEL 109R

NPC 25 Amp Regulated Power Supply. 4-Way Protected. Output Voltage and Current Meters.

Extra heavy-duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 10 amps continuous, 25 amps max. All solid state. Features dual current overload, overvoltage and thermal protection. Ideally suited for operating mobile Ham radio and linear amplifier in your home or office. Excellent bench power supply for testing and servicing of mobile communications equipment.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	80 mV	100 mV
Ripple Noise	5 mV RMS	10 mV RMS
Transient Response	20 uSec	
Current Continuous	10 Amp	
Current Limit	26 Amp	
Overvoltage Protection	14.5 V	15 V
Thermal Overload	180°F	

Case: 4¾" (H) x 9" (W) x 8½" (D). Shipping Weight: 15 lbs.

MODEL 12V4

NPC 1.75 Amp Power Supply. 3 Amp Max.

Functions silently in converting 115 volts AC to 12 volts DC. Ideally suited for most applications including 8-track stereo, burglar alarm, car radio and cassette tape player within power rating.

Continuous Current (Full Load)	1.75 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.4 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 108RM

NPC 12 Amp Regulated Power Supply. Solid State. 3-Way Protected. Current Meter.

This heavy duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 8 amps continuous, 12 amps max. All solid state. Features dual current overload and overvoltage protection. Ideally suited for operating mobile Ham radio 2 meter AM-FM-SSB transceivers in your home or office. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	8 Amp	
Current Limit	12 Amp	
Current Foldback	2.5 Amp	
Over-voltage Protection	14.5 V	15 V

Case: 4¼" (H) x 7½" (W) x 5½" (D). Shipping Weight: 9.5 lbs.

ALSO AVAILABLE AS MODEL 108RA WITHOUT METER AND OVERVOLTAGE PROTECTION.

MODEL 104R

NPC 6 Amp Power Supply Regulated. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 4 amps continuous and 6 amps max. Ideally suited for applications where excellent DC stability is important, such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can be used to trickle-charge 12 volt car batteries.

	MAXIMUM	TYPICAL
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	4 Amp	
Current Limit	6 Amp	
Current Foldback	2 Amp	

Case: 3½" (H) x 5½" (W) x 6½" (D). Shipping Weight: 6 lbs.

MODEL 102

NPC 2.5 Amp Power Supply. 4 Amp Max. Solid State. Overload Protected.

Functions silently in converting 115 volts AC to 12 volts DC. 2.5 amps continuous, 4 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette tape player or car radio in a home or office.

Continuous Current (Full Load)	2.5 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.6 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 4 lbs.

MARINE & RV

MODEL 12-115

NPC 12-115 Solid State Inverter. 200 W. Parallel Connection for Higher Power up to 350 W.

Converts 12 volts DC to 115 volts AC @ 60 Hz output. 200 watts continuous operation with peak power up to 240 watts. All silicon semiconductors assure high reliability at excessive ambient temperatures. The output voltage is a square wave. The inverter is not recommended where high transients are not tolerable.

The 12-115 allows you to have AC house current in your boat, car, truck, camper, house trailer, or houseboat. Will operate small household appliances, T.V., hand tools, electric shaver, AC radios, and lights within power rating. Built-in overload protection.

	12 VDC IN	14 VDC IN
Output Voltage (No Load)	115 V RMS	130 V RMS
Output Voltage (Full Load)	100 V RMS	115 V RMS
Frequency (No Load)	58 Hz	66 Hz
Frequency (Full Load)	54 Hz	62 Hz
Power Continuous	200W	
Power Peak	240W	
Parallel Connection	350W	

All Values Are Typical

Case: 4½" (H) x 7½" (W) x 5½" (D). Shipping Weight: 7 lbs.

MODEL 612

Model 612 Power Converter

NPC 612 converts 6 volt negative ground or 12 volt positive ground electrical systems to 12 volt negative ground operation. Provides full 3 amp continuous power. The inexpensive solution for installing car radios, stereo and cassette tape players, in vehicles with 6 volt negative ground or 12 volt positive ground systems.

Case: 2¾" (H) x 3" (W) x 5" (D). Shipping Weight: 1 lb.

6 METER BEAMS

3 - 5 - 6 - 10 ELEMENTS

Proven performance from rugged, full size, 6 meter beams. Element spacings and lengths have been carefully engineered to give best pattern, high forward gain, good front to back ratio and broad frequency response.

Booms are .058 wall and elements are 3/4" - 5/8" .049 wall seamless chrome finish aluminum tubing. The 3 and 5 element beams have 1 3/8" - 1 1/4" booms. The 6 and 10 element beams have 1 5/8" - 1 1/2" booms. All brackets are heavy gauge formed aluminum. Bright finish cad plated ubolts are adjustable for up to 1 5/8" mast on 3 and 5 element and 2" on 6 and 10 element beams. All models may be mounted for horizontal or vertical polarization.

New features include adjustable length elements, kilowatt Reddi Match and built-in coax fitting for direct 52 ohm feed. These beams are factory marked and supplied with instructions for quick assembly.

Description	3 element	5 element	6 element	10 element
Model No.	A50-3	A50-5	A50-6	A50-10
Boom Lngth	6'	12'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	28 dB
Weight	7 lbs.	11 lbs.	18 lbs.	25 lbs.

new
RINGO RANGER for FM

4.5 dB* — 6 dB Omnidirectional GAIN BASE STATION ANTENNAS**

FOR MAXIMUM PERFORMANCE AND VALUE

Cush Craft has created another first by making the world's most popular 2 meter antenna twice as good. The new Ringo Ranger is developed from the basic AR-2 with three half waves in phase and a one eighth wave matching stub. Ringo Ranger gives an extremely low angle of radiation for better signal coverage. It is tunable over a broad frequency range and perfectly matched to 52 ohm coax.

ARX-2, 137-160 MHz, 4 lbs., 112"
ARX-220, 220-225 MHz, 3 lbs., 75"
ARX-450, 435-450 MHz, 3 lbs., 39"

* Reference ½ wave dipole.
** Reference ¼ wave whip used as gain standard by many manufacturers.

Work full quieting into more repeaters and extend the radius of your direct contacts with the new Ringo Ranger.

You can up date your present AR-2 Ringo with the simple addition of this extende. kit. The kit includes the phasing network and necessary element extensions. The only modifications required are easy to make saw slits in the top section of your antenna.

ARX-2K CONVERSION KIT

2 METER ANTENNAS FM

A-FM RINGO 2.75 dB Gain (reference ¼ wave whip). Half wave length antennas with direct dc ground, 52 ohm feed takes PL-259, low angle of radiation with 1-1 SWR. Factory preassembled and ready to install. 6 meter partly preassembled, all but 450 MHz take 1¼" mast. There are more Ringos in use than all other FM antennas combined.

Model Number	AR-2	AR-25	AR-6	AR-220	AR-450
Frequency MHz	135-175	135-175	50-54	220-225	440-460
Power—Mdg. Watts	100	500	100	100	200
Wind area sq. ft.	.21'	.21'	.27'	.20'	.10'

8-4 POLE Up to 9 dB Gain over a ½ wave dipole. Overall antenna length 147 MHz — 33' 220 MHz — 15', 435 MHz — 8', pattern 360° — 6 dB gain, 150° — 9 dB gain, 52 ohm feed takes PL 259 connector. Package includes 4 complete dipole assemblies on mounting booms, harness and all hardware. Vertical support mast not supplied.

AFM-4D 144 - 150 MHz, 1000 watts, wind area 2.50 sq. ft.
AFM-24D 220 - 225 MHz, 1000 watts, wind area 1.05 sq. ft.
AFM-44D 435 - 450 MHz, 1000 watts, wind area 1.13 sq. ft.

D-POWER PACK The big signal (22 element array) for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 24 dB, ½ power beamwidth 42°, dimensions 144" x 96" x 46", turn radius 66", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

A147-22 146 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

D-YAGI STACKING KITS VPK includes horizontal mounting boom, harness, hardware and instructions for two vertically polarized yagis gives 1.4dB gain over the single antenna.

A14-VPK,	complete 4 element stacking kit
A14-SK,	4 element coax harness only
A147-VPK,	complete 11 element stacking kit
A147-SK,	11 element coax harness only
A449-SK,	8 or 11 element coax harness only

6-4-6-11 ELEMENT YAGIS The standard of comparison in VHF-UHF communications, now cut for FM and vertical polarization. The four and six element models can be tower side mounted. All are rated at 1000 watts with direct 52 ohm feed and PL-258 connectors.

Model Number	A147-11	A-147-6	A449-11	A449-6	AT50-11
Boom./Longest ele.	144"/40"	44"/40"	40"/13"	20"/26"	102"/26"
Wght./Turn radius	6 lbs., 72"	3 lbs., 44"	4 lbs., 40"	3 lbs., 18"	8 lbs., 51"
Gain/F/B ratio dB	13.2/26	9/20	13.2/26	11/25	13.2/26
½ Power beam	40°	66°	48°	60°	40°
Wind area sq. ft.	1.35	.63	.20	.20	.50
Frequency MHz	146-148	146-148	440-450	440-450	220-225

F-FM TWIST 12.4 dB Gain: Ten elements horizontal polarization for low end coverage and ten elements vertical polarization for FM coverage. Forward gain 12.4 dB, F/B ratio 22 dB, boom length 130", weight 10 lbs., longest element 40", 52 ohm Reddi Match driven elements take PL-259 connectors, uses two separate Feed lines.

A147-20T 145 - 147 MHz, 1000 watts, wind area 1.42 sq. ft.

HIGH PERFORMANCE VHF YAGIS

3/4, 1-1/4, 2 METER BEAMS

The standard of comparison in amateur VHF/UHF communications Cush Craft yagis combine all out performance and reliability with optimum size for ease of assembly and mounting at your site.

Lightweight yet rugged, the antennas have 3/16" O. D. solid aluminum elements with 5/16" center sections mounted on heavy duty formed brackets. Booms are 1" and 7/8" O.D. aluminum tubing. Mast mounts of 1/8" formed aluminum have adjustable u-bolts for up to 1-1/2" O.D. masts. They can be mounted for horizontal or vertical polarization. Complete instructions include data on 2 meter FM repeater operation.

New features include a kilowatt Reddi Match for direct 52 ohm coaxial feed with a standard PL-259 fitting. All elements are spaced at .2 wavelength and tapered for improved bandwidth.

Model No.	A144 7	A144 11	A220 11	A430 11
Description	2m	2m	1¼m	70m
Elements	7	11	11	11
Boom Lngth.	98"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	26 dB	26 dB	26 dB
Fwd. Lobe @ ½ pwr. pt.	46	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1

VHF/UHF BEAMS			
A50-3	$ 27.50	A144-7	19.95
A50-5	39.50	A144-11	24.95
A50-6	59.50	A430-11	19.95
A50-10	89.50		
AMATEUR FM ANTENNAS			
A147-4	$ 15.95	AFM-44D	47.50
A147-11	24.95	AR-2	18.50
A147-20T	47.50	AR-6	24.50
A147-22	69.50	AR-25	21.50
A220-7	18.95	AR-220	18.50
A220-11	22.95	AR-450	18.50
A449-6	15.95	ARX-2	28.50
A449-11	21.95	ARX-2K	11.95
AFM-4D	53.50	ARX-220	28.50
AFM-24D	49.50	ARX-450	28.50

Description:	*144 MHz.* Model:	Price:	*220 MHz.* Model:	Price:	*432 MHz.* Model:	Price:
20 Element DX-Array	DX-120	$39.50	DX-220	$32.50	DX-420	$29.50
Frame & Harness (40 E.)	DXK-140	$52.50	DXK-240	$48.50	DXK-440	$36.50
Frame & Harness (80 El.)	DXK-180	$100.00	DXK-280	$85.00	DXK-480	$70.00
1-1 52-ohm Balun	DX-1BN	$10.95	DX-2BN	$10.95	DX-4BN	$10.95
Vert. Pol. Bracket (20 El.)	DX-VPB	$8.95	DX-VPB	$8.95	DX-VPB	$8.95

TUFTS RADIO CATALOG TUFTS RADIO

TUFTS RADIO CATALOG TUFTS RADIO

vhf engineering

THE WORLD'S MOST COMPLETE LINE OF VHF-FM KITS AND EQUIPMENT

RECEIVERS

RX28C	28-35 MHz FM receiver with 2 pole 10.7 MHz crystal filter	59.95
RX50C Kit	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX144C Kit	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T.	same as above – factory wired and tested	114.95
RX220C Kit	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T	same as above – factory wired and tested	114.95
RX432C Kit	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50

RF28 Kit	10 meter RF front end 10.7 MHz output	12.50
RF50 Kit	6 meter RF front end 10.7 MHz output	12.50
RF144D Kit	2 meter RF front end 10.7 MHz output	17.50
RF220D Kit	220 MHz RF front end 10.7 MHz output	17.50
RF432 Kit	432 MHz RF front end 10.7 MHz output	27.50
IF 10.7F Kit	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

TRANSMITTERS

TX144B Kit	transmitter exciter – 1 watt – 2 meters	$ 29.95
TX144B W/T.	same as above – factory wired and tested	49.95
TX220B Kit	transmitter exciter – 1 watt – 220 MHz	29.95
TX220B W/T.	same as above – factory wired and tested	49.95

TX432B Kit.	transmitter exciter 432 MHz	39.95
TX432B W/T	same as above - factory wired and tested	59.95
TX150 Kit	300 milliwatt, complete 2 meter transmitter, less crystal and mike	19.95

POWER AMPLIFIERS

PA2501H Kit.	2 meter power amp – kit 1 w in – 25w out with solid state switching, case, connectors	59.95
PA2501H W/T.	same as above – factory wired and tested	74.95
PA4010H Kit.	2 meter power amp – 10w in – 40w out – relay switching	59.95
PA4010H W/T.	same as above – factory wired and tested	74.95
PA144/15 Kit.	2 meter power amp – 1w in – 15w out – less case, connectors and switching	39.95

PA144/25 Kit.	similar to PA144/15 kit except 25w out	49.95
PA220/15 Kit.	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit.	power amp – similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10	10w in – 140w out – 2 meter amp – factory wired and tested	179.95
PA140/30	30w in – 140w out – 2 meter amp – factory wired and tested	159.95

POWER SUPPLIES

PS15C Kit	15 amp – 12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	79.95
PS15C W/T	same as above – factory wired and tested	94.95
PS25C Kit	25 amp – 12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	129.95
PS25C W/T	same as above – factory wired and tested	149.95

O.V.P.	adds over voltage protection to your power supplies, 15 VDC max	9.95
PS3A Kit	12 volt – power supply regulator card with fold back current limiting	8.95
PS3012	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/foldback current limiting and over voltage protection, wired and tested	239.95

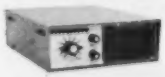
REPEATERS

RPT28 Kit	repeater – 10 meter	TBA
RPT28	repeater – 10 meter, wired & tested	TBA
RPT50 Kit	repeater – 6 meter	TBA
RPT50	repeater – 6 meter, wired & tested	TBA
RPT144 Kit	repeater – 2 meter – 15w – complete (less crystals)	465.95
RPT220 Kit	repeater – 220 MHz – 15w – complete (less crystals)	465.95
RPT432 Kit	repeater – 10 watt – 432 MHz (less crystals)	515.95

RPT144	repeater – 15 watt – 2 meter – factory wired and tested	695.95
RPT220	repeater – 15 watt – 220 MHz – factory wired and tested	695.95
RPT432	repeater – 10 watt – 432 MHz – factory wired and tested	749.95
DPLX144	2 meter, 600 KHz spaced duplexer, wired and tuned to frequency	399.95
DPLX220	220 MHz duplexer, wired and tuned to frequency	399.95

TRANSCEIVERS

TRX 144 Kit	case and all components to build 15 watt 10 channel scanning 2 meter transceiver (less mike and crystals)	219.95
TRX 220 Kit	same as above except for 220 MHz	219.95
TRX 432 Kit	same as above except 10 watt and 432MHz	254.95



SYNTHESIZERS

SYN II Kit	2 meter synthesizer, transmit offsets programmable from 100 KHz - 10 MHz, (Mars offsets with optional adapters)	169.95
SYN II	same as above, wired and tested	239.95

WALKIE TALKIES

HT 144B Kit.	2 meter, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex	129.95
NICAD	battery pack, 12 VDC, ½ amp	29.95
NICAD	battery charger	5.95
Rubber Duck	2 meter, with male BNC connector	8.95

OTHER PRODUCTS BY VHF ENGINEERING

CD1 Kit	10 channel receive xtal deck w/ diode switching	6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD-3 Kit	UHF version of CD-1 deck, needed for 432 multi-channel operations	12.95
COR2 Kit	complete COR with 3 second and 3 minute timers	19.95
SC3 Kit	10 channel auto-scan adapter for RX with priority.	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each)	5.00
CWID Kit	159 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed	59.95
Microphone	2,000 ohm dynamic mike with P.T.T. and coil cord	9.95

Now You Can Receive The Weak Signals With The ALL NEW AMECO PREAMPLIFIER

Model PT-2 is a continuous tuning 6-160 meter Pre-Amp specifically designed for use with a transceiver. The PT-2 combines the features of the well-known PT with new sophisticated control circuitry that permits it to be added to virtually any transceiver with No modification. No serious ham can be without one.

- **Improves sensitivity and signal-to-noise ratio.**
- **Boosts signals up to 26 db.**
- **For AM or SSB.**
- **Bypasses itself automatically when the transceiver is transmitting.**
- **FET amplifier gives superior cross modulation protection.**
- **Advanced solid-state circuitry.**
- **Simple to install.**
- **Improves immunity to transceiver front-end overload by use of its built-in attenuator.**
- **Provides master power control for station equipment.**

MODEL PT-2

$69.95

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model 372 CLIPREAMP

Model 372 – $27.50

Get maximum legal modulation without danger of splatter. Solid-state speech preamplifier and clipper for transmitters, public-address systems, and tape recorders needs no external power.

• specifications

Input Impedance	100,000 ohms
Input Levels	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	50 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	2-3/4" × 3" × 4-1/8"
Shipping Weight	7 oz.
Connectors	Terminal strip

COAXIAL ANTENNA CHANGEOVER RELAY

model 377

Model 377 – $17.95

Economical and reliable. Can be operated from VOX circuit for completely automatic operation or from PTT or manual T/R switch. Receiver input is automatically grounded when the relay is in the Transmit position. Wide AC operating voltage range and low operating current.

• specifications

Power Rating	1000 watts CW (2000 watts SSB)
VSWR	Less than 1.15:1, DC to 150 MHz
Power Requirements	0.015 Ampere, 48 to 130 volts AC
Connectors	UHF Type SO-239
Dimensions	3-1/2" × 1-1/2"
Shipping Weight	1 lb.

UNIVERSAL HYBRID COUPLER II PHONE PATCH

model 3002W and model 3001W

Model 300 2W with *Compreamp* – $125.00

Model 300 1W without *Compreamp* – $85.00

Connect your station to the telephone lines. Five switch-selectable modes give complete flexibility for patching the station to the line and for tape recording and playback to or from the line or the station. The hybrid circuit provides for effortless VOX operation of the phone patch. A built-in *Compreamp* speech preamplifier/limiter (in Model 3002W) increases the level of weak phone signals and also prevents overmodulation when the local telephone is used as the station microphone. (The *Compreamp* also functions as a preamplifier/limiter with the station microphone, if desired.)

• specifications

Inputs from:	
Line	600 ohms
Receiver	4 ohms
Microphone	High impedance (50,000 ohms) crystal or dynamic
Tape Recorder	4 ohms
Outputs to:	
Transmitter	50,000 ohms
Speaker	4 ohms
Tape Recorder	0.5 megohm
Size	9-1/2" × 7-1/2" × 5"
Shipping Weight	3-1/2 lbs.
Power	9-volt battery, Burgess 2U6 or equivalent
Connectors	Phone

B&W

BARKER & WILLIAMSON, INC

Model 359 – $37.50

Increase your transmitter's effective speech power up to four times. Or use it with your tape recorder or public address system for improved performance. This two-stage, transistorized Audio Preamplifier/Limiter can be used with all types of transmitters. Powered by a long-lasting dry-cell battery—no external power needed. Installs without any wiring changes in your transmitter. Just connect the *Compreamp* between your microphone (50,000-ohm dynamic or high-impedance ceramic) and your transmitter's microphone input connector. Front-panel rocker switch lets you bypass the *Compreamp* when you want to. Compression level is adjustable, too.

• specifications

Input Impedance	100,000 ohms
Input Level	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	50 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	2-3/4" × 3" × 4-1/8"
Shipping Weight	9-1/2 oz.
Connectors	Terminal strip

COAXIAL SWITCHES AND ACCESSORIES

for antenna selection and RF switching

These high-quality switches have set the standard for the industry for years. Ceramic switches with silver-alloy contacts and silver-plated conductors give unmatched performance and reliability from audio frequencies to 150 MHz.

B&W coaxial switches are designed for use with 52- to 75-ohm non-reactive loads, and are power rated at 1000 watts AM, 2000 watts SSB. Connectors are UHF type. Insertion loss is negligible, and VSWR is less than 1.2:1 up to 150 MHz.

Crosstalk (measured at 30 MHz) is -45 dB between adjacent outlets and -60 dB between alternate outlets.

Models are available for desk, wall, or panel mounting, and with or without protective grounding of inactive outputs. Radial (side-mounted) connector models can be either wall or panel mounted; axial (backplate-mounted) connector models are for panel mounting only, save panel space.

Use the selector chart below to choose the models you need.

Model 560A

Model 590

Model 590G

Model 561A

Model 592

Model 596

COAXIAL SWITCH SELECTOR CHART

Model	PRICE	Outputs	Connector Placement	Mounting: Panel	Mounting: Wall	Mounting: Desk	Automatic Grounding	Dial Plate	Remarks
375	18.95	6	Axial	x			x	Supplied	PROTAX switch. Grounds all except selected output circuit.
376	18.95	5	Radial	x	x		x	Supplied	PROTAX switch. Grounds all except selected output circuit. Sixth switch position grounds all outputs.
560A	14.00	5	Radial	x	x			DP-5	
560A-2	12.50	2	Radial	x	x			DP-2	
561A	17.50	2	Radial	x	x			DP-2	Special 2-pole, 2-position switch used to switch any RF device in or out of series connection in a coaxial line. See figure (over).
596	.95	–	–		x			–	Bracket only, for wall mounting of radial connector switches.
590	17.95	5	Axial	x				DP-5	
590G	17.95	5	Axial	x			x	Supplied	Grounds all except selected output circuit.
592	16.50	2	Axial	x				DP-2	
595	18.50	6	In-line		x	x	x		Grounds all except selected output circuit.

Model 375

Model 376

Model 560A-2

TUFTS RADIO CATALOG TUFTS RADIO

The indispensable BIRD model 43 THRULINE® Wattmeter

BIRD

Read RF Watts Directly.

0.45-2300 MHz, 1-10,000 watts ±5%, Low Insertion VSWR—1.05.

Unequalled economy and flexibility: Buy only the element(s) covering your present frequency and power needs, add extra ranges later if your requirements expand.

Table 1 — STANDARD ELEMENTS (CATALOG NUMBERS)

Power Range	Frequency Bands (MHz) 2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

Table 2 — LOW-POWER ELEMENTS

1 watt	Cat. No.	2.5 watts	Cat. No.
60-80 MHz	060-1	60-80 MHz	060-2
80-95 MHz	080-1	80-95 MHz	080-2
95-125 MHz	095-1	95-150 MHz	095-2
110-160 MHz	110-1	150-250 MHz	150-2
150-250 MHz	150-1	200-300 MHz	200-2
200-300 MHz	200-1	250-450 MHz	250-2
275-450 MHz	275-1	400-850 MHz	400-2
425-850 MHz	425-1	800-950 MHz	800-2
800-950 MHz	800-1		

mounts - leads - accessories

STANDARD GAIN MOBILES
Two Meters
- 5/8 wavelength — 3.4 db gain over 1/4 wave mobile
- Frequency coverage—143 to 149 MHz
- Power rating—300 watts PM

MODEL SBLT-144
47" antenna complete with easy to install, no holes to drill, trunk lip mount, impact spring and 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $33.75

MODEL SBL-144
47" antenna mounts on any flat surface, roof, deck or fender in ¾" hole. Includes impact spring, 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $31.65

HUSTLER "BUCK-BUSTER"
MODEL BF-2
91" fan meter, 5/8 wavelength, 3.4 db gain over 1/4 wave mobile. Designed with ¾"-24 base to fit your mount or a wide selection of Hustler mobile mounts. Mount or cable not included.
Price: $9.00

DELUXE MOBILE MOUNTS
For medium length, light weight antennas with ¾"—24 base

MODEL TLM
Trunk lip mount for no holes installation on side or edge of trunk lid. Includes 17' RG-58-U connectors attached.
Price: $14.95

MODEL MLM
Deluxe trunk lip mount with 180 degree swivel ball for positioning antenna to vertical. Easy — no holes — installation. Includes 17' RG-58-U cable and connectors attached. Price: $17.20

MODEL MCM-1
Rain gutter mount fits all shapes, angles even lowest trim line gutters. Includes 180° swivel ball.
Price: $9.00

MODEL MM-1
Cowl mount installs in 1" hole. Includes 180° swivel ball and SO-239 connector.
Price: $7.50

MODEL TBM-1
Trunk groove mount installs in hidden area of trunk under trunk lid. Mounting hardware included.
Price: $8.00

SUPER GAIN MOBILES
Two Meters
- 5.2 db gain over 1/4 wave mobile antenna
- Frequency coverage—143-149 MHz
- SWR at resonance—1.1:1 typical
- Power rating—300 watts PM

TWO AND SIX METERS—TRUNK LIP MOUNT
BROAD NFT
Four section telescopic antenna permits separate adjustment for simultaneous resonance on two and six meters. Operational height: 48". Complete with trunk lip mount, 17' MIL SPEC RG-58-U and factory attached PL-259.
Price: $22.95

VHF/UHF ANTENNA—ROOF MOUNT
MODEL UNT-1
Field trimmable radiator for 1/4 wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Mounts on any flat surface, roof, deck, fender in ¾" hole. Includes 15' RG-58-U.
Price: $9.95

RESONATOR SPRING—STAINLESS STEEL
MODEL RSS-2
Installs between Hustler mast and resonator. Absorbs shock when operating vertical whip-type antenna. Supplied ready to assemble.
Price: $3.50

MODEL CGT-144
Get big signal performance, superior receiving capability with this 85° collinear antenna. Easy installation on side or edge of trunk lip without drilling — complete with 17' MIL SPEC RG-58-U and PL-259.
Price: $41.30

MODEL CG-144
Same characteristics as CGT-144 supplied with ¾"-24 base to fit all mobile ball mounts — Length is 83". Mount and cable not included.
Price: $35.80

VHF/UHF ANTENNA—TRUNK LIP MOUNT
MODEL THF
Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259.
Price: $16.55

STAINLESS STEEL BALL MOUNT FOR DECK, FENDER OR ANY FLAT SURFACE
MODEL SSM-2
Heavy 3" reinforced stainless steel U-bolt adjustable ball mount easily supports any amateur mobile antenna. Includes coiled base, steel back-up plate and mounting hardware.
Price: $19.20

QUICK DISCONNECT—100% STAINLESS STEEL
MODEL QD-1
Remove antenna from mount with easy press and twist release. Corrosion resistant spring and all parts 100% stainless steel. ¾"-24 threads—female one end, male the other.
Price: $16.95

FEED LINE MODEL L-14-240
Get known performance, maximum shielding for minimum noise pick-up in this RG, SPEC 58 length of RG-58-U cable. Supplied with connectors attached for use with ball or bumper mount and transceiver.
Price: $6.85

MODEL 06-144A — Deluxe, two-station Coilmeter for Repeater or any fixed station operation. 6 db. gain over a ½ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator ⅝ wave lower section, ½ wave phasing ⅜ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts PM. Wind survival: 100 MPH. Installs on vertical pipe up to 1¼" O.D. SO 239 coax connector
Price: $67.88

MODEL SM-2
Ball mount complete with mounting hardware.
Price: $8.30

HUSTLER RESONATORS

All resonators are precision wound with optimized design for each band. Assembly includes 17-7 PH stainless steel adjustable tip rod for lowest SWR and band edge marker. Choose for medium or high power operation.

STANDARD HUSTLER RESONATORS—Power Rating: 400 watts SSB

Model	Band	Price
RM-10	10 meters	$10.75
RM-15	15 meters	$11.75
RM-20	20 meters	$12.75
RM-40	40 meters	$13.75
RM-75	75 meters	$15.95
RM-80	80 meters	$16.95

SUPER HUSTLER RESONATORS—Power Rating: Legal Limit SSB. Supports have widest band-width

Model	Band	Price
MO-10-S	10 meters	$13.95
MO-15-S	15 meters	$13.95
MO-20-S	20 meters	$13.95
MO-40-S	40 meters	$13.95
MO-75-S	75 meters	$15.95
MO-80-S	80 meters	$16.95

RM-5 RM-10 4-STV

Covers 10 - 15 - 20 - 40 Meters
Only Hustler Gives One Setting for Whole Band Coverage

MODEL 4-STV
- Lowest SWR—PLUS.
- Bandwidth at its broadest! SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers "Spritz" extruded to otherwise unobtainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch fiberglass trap forms for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with low loss — high strength insulators. Mounting hardware included.
- All sections 1¼" heavy wall, high strength aluminum.
- Stainless steel clamps permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be easiest assembly of any multi-band vertical.
- Antenna has ¾"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for 75 meter operation when desired.
- Top loading on 75 meters for broader bandwidth and higher radiation efficiency!
- Feed with any length 50 ohm coax.
- Power capability—full legal limit on SSB or CW.
- Mounting: Ground mount with or without radials, or roof mount with radials.

Length: 23' 9"
MODEL 4-STV
Weight: 15 lbs.
Price: $99.95

For 6 - 10 - 15 - 20 - 40 - 75 - 80 Meters

Fold over mast for quick and easy interchange of resonators or entering a garage. When operating, mast is held vertical with shakeproof sleeve clutch. 54" mast also serves as 1/4 wavelength 6 meter antenna. Stainless steel base has ¾"-24 threads to fit mobile ball mount or bumper mount.

HUSTLER MASTS
The Majority Choice of Amateurs Throughout the World!

MODEL MO-2
For bumper mounting—Fold is at roof line 27" above base.
Price: $22.00

MODEL MO-1
For deck or fender mounting—Fold is at roof line 15" above base.
Price: $22.00

MO-1 MO-2

HUSTLER

SUPER AMP from DenTron

$499.50

If the amplifier you're thinking of buying doesn't deliver at least 1000 to 1200 watts output, to the antenna, you're buying the wrong amplifier.

Our New Super Amp is sweeping the country because hams have realized that the DenTron Amplifier will deliver to the antenna, (output power), what other manufacturers rate as input power.

The Super Amp runs a full 2000 watts P.E.P. input on SSB, and 1000 watts DC on CW, RTTY or SSTV 160-10 meters, the maximum legal power.

The Super Amp is compact, low profile, has a solid one-piece cabinet assuring maximum TVI shielding.

The heart of our amplifier, the power supply, is a continuous duty, self-contained supply built for contest performance.

We mounted the 4 - 811 A's, industrial workhorse tubes, in a cooling chamber featuring the on-demand variable cooling system.

The hams at DenTron pride themselves on quality work, and we fight to keep prices down. That's why the dynamic DenTron Linear Amplifier beats them all at $499.50.

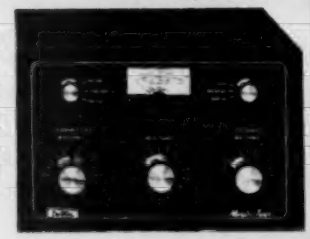
NOW AVAILABLE WITH 572 B's FOR **$574.50**

DenTron

Match everything from 160 to 10 with the new 160-10 MAT

NEW: The Monitor Tuner was designed because of overwhelming demand. Hams told us they wanted a 3 kilowatt tuner with a built-in wattmeter, a front panel antenna selector for coax, balanced line and random wire. So we engineered the 160-10m Monitor Tuner. It's a lifetime investment at $299.50.

$299.50



Meet the SuperTuner

The DenTron Super Tuner tunes everything from 160-10 meters. Whether you have balanced line, coax cable, random or long wire, the Super Tuner will match the antenna impedance to your transmitter. All DenTron tuners give you maximum power transfer from your transmitter to your antenna, and isn't that where it really counts?

1 KW MODEL **$129.50** 3 KW MODEL **$229.50**

DenTron

The 80-10 Skymatcher

Here's an antenna tuner for 80 through 10 meters, handles 500 w P.E.P. and matches your 52 ohm transceiver to a random wire antenna.

- Continuous tuning 3.2 - 30 mc
- "L" network
- Ceramic 12 position rotary switch
- SO–239 receptional to transmitter
- Random wire tuner
- 3000 volt capacitor spacing
- Tapped inductor
- Ceramic antenna feed thru
- 7" W. 5" H. 8" D., Weight: 5 lbs.

$59.50

Read forward and reflected watts at the same time

Tired of constant switching and guesswork?

Every serious ham knows he must read both forward and reverse wattage simultaneously for that perfect match. So upgrade with the DenTron W-2 Dual in line Wattmeter.

$99.50

DenTron

The Sky Openers

SKYMASTER

A fully developed and tested 27 foot vertical antenna covers entire 10, 15, 20, and 40 meter bands using only one directly applied wave trap. A full 1/4 wave antenna on 20 meters. Constructed of heavy seamless aluminum with a factory tuned and sealed HQ Trap, SKYMASTER is weatherproof and withstands winds up to 80 mph. Handles 2 KW power level and is for ground, roof or tower mounting. Radials included in our low price of

$84.50

Also 80 m resonator for top mounting on SKYMASTER.

$29.50

SKYCLAW

A tunable monoband high performance vertical antenna, designed for 40, 80, 160 meter operation. SKYCLAW gives you the following spectrum coverage:

BAND (Meters)	BANDWIDTH (kHz)
160	60
80	200
40	entire band

Tuning is easy and reliable. Rugged construction assures that this self-supporting unit is weatherproof and survives nicely in 100 mph winds.. Handles full legal power limit.

$79.50

EX-1

The DenTron EX-1 Vertical Antenna is designed for the performance minded antenna experimenter. The EX-1 is a full 40 meter, ¼ wave, 33', self-supporting vertical. The EX-1 is the ideal vertical for phasing.

$59.50

TRIM-TENNA

The antenna your neighbors will love. The new DenTron Trim-Tenna with 20 meter beam is designed for the discriminating amateur who wants fantastic performance in an environmentally appealing beam. It's really loaded! Up front there's a 13 foot 6 inch director with precision Hy-Q coils. And, 7 feet behind is a 16 foot driven element fed directly with 52 ohm coax. The Trim-Tenna mounts easily and what a difference in on-the-air performance between the Trim-Tenna and that dipole, long wire or inverted Vee you've been using. 4 & 6 Forward Gain Over Dipole.

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ALL BAND DOUBLET

This All Band Doublet or Inverted Type Antenna covers 160 thru 10 meters. Has total length of 130 feet (14 ga. stranded copper) although it may be made shorter if necessary. This tuned Doublet is center fed through 100 feet of 400 ohm PVC covered balanced transmission line. The assembly is complete. Add rope to the ends and pull up into position. Tune with the DenTron Super Tuner and you're on 10 through 160 meters with one antenna! Now just for the DenTron All Band Doublet.

$24.50

DenTron

TUFTS RADIO CATALOG TUFTS RADIO

Ronald Perry WA2CGA
RD 1, Glen Avenue
Fishkill NY 12524

The Agonies of Tower Raising

- - Murphy strikes again...as usual

For many years I debated, planned, and agonized over the purchase and installation of a decent-sized tower for my home station. Though money was a definite factor in the project, other considerations such as location, base configuration, type and size of tower, and local building ordinances presented the main concerns.

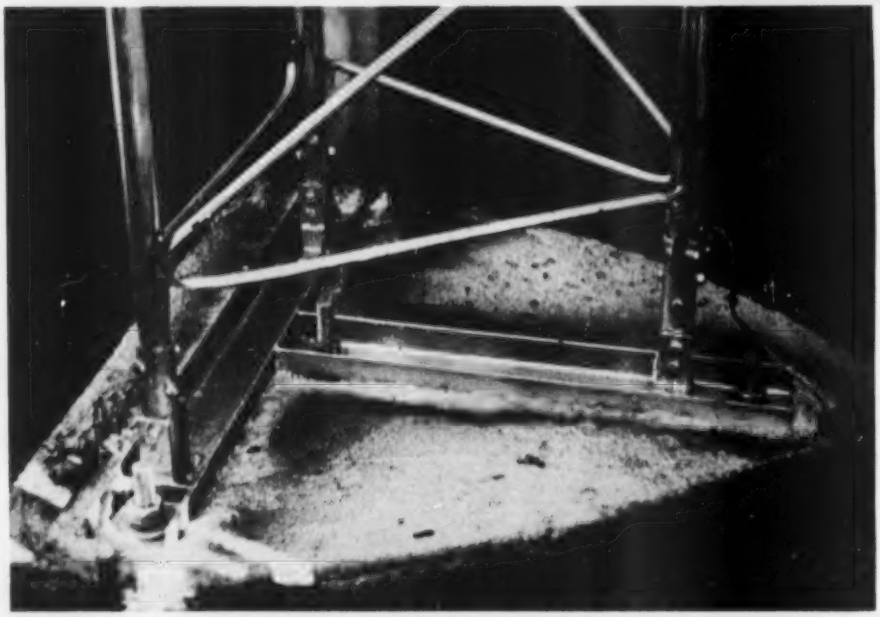
When using VHF/UHF (2 meters, 220 and 450 MHz), tower location and height become very important factors. The tower must be high for good communications and yet close to the rig since feedline losses mount with cable length. Based on this, I decided to use a 60 foot tower located a wall away from my equipment. For ease of installation and maintenance, I decided to use Universal's Model 14-60 self-standing aluminum tower with a hinged base.[1] This tower, according to the manufacturer, will support 14 square feet of antenna in an 80 mile an hour wind with a safety factor. The lack of the need of guy wires was a major consideration since guy anchors would mean more problems.

Having decided on the tower height and location, the next task was designing the tower base configuration. Normally this would not be a big deal – get some idiot to dig you a big hole and fill it with concrete – but what about a solid rock ledge of New York State granite for a backyard?

To solve this matter, I thought about employing a jackhammer to dig the hole. However, after consulting with a friend in the construction business, I decided against this expensive back-breaking procedure. I then considered a few sticks of dynamite, but notwithstanding the damage to the QTH, blasting permits were hard to come by. Discussing the matter on the local repeater WR2ABB, a friend WA2HSF advised using a core drill which bores a clean, round hole into rock. This matter being resolved, I finally checked out all local building and tower restrictions and ordinances to see that there were no laws forbidding my little project. Luckily, the laws were with me so out came the checkbook and the shovels and soon groundbreaking was at hand.

The photo shows the base and the four securing rods. The right side of the base is about 3-4 inches below ground level while the left side is about 7-8 inches. The holes for the rods were drilled with an electric core drill and a diamond/carbide bit. Both were rented from a local rental agency for $28/day. Each hole is 1½ inches in diameter, about 8-9 inches deep, and each took about 50-60 minutes to drill. The rods are 7/8 inch diameter steel and are threaded their entire length.

To secure the rods in the rock, commercial rock anchors (threaded Ring Wedge Cinch Anchors) were used.[2] These anchors are a combination iron wedge/metal ring/lead alloy unit. They are threaded on and over the rods and expanded within the hole through the use of a separate pipe and sledge hammer. I used three units in each hole as specified by the manufacturer. With this



View showing the base with its four securing rods.

arrangement, each rod can take a maximum tension test load of 14,440 pounds (57,760 pounds total) and a maximum shear test load of 36,130 pounds (144,520 pounds total). See Fig. 1.

Once the rods were set in place, the concrete for leveling the base was poured. Approximately 1¼ yards of concrete was required to make the base extend four inches above the ground level. The finished concrete had a comprehensive strength of approximately 3000 psi.

Leveling of the tower was straightforward once the concrete began to age. The flat-roof mount with hinged base was placed on the concrete and leveled. The bottom 10 foot section of the tower was put in place and leveled. Actually, this is a lie since it didn't work out that way. That is, two of the three legs were level while the third was way out of true. After a few minutes of puzzlement, the mystery was solved – the tower tapers inward from the bottom to the top to accept the next smaller section. A quick readjustment was made so that each leg of the tower was off perpendicular towards the center of the tower by the same amount. With this crisis passed, the concrete was allowed to age for seven days.

Now the second phase of the project began. A crew was assembled consisting of W2BEV, WB2COY, WB2CTH, WB2HDS, and WA2QWP. The first step was to put the tower together, 10 foot sections one at a time. Thanks to the hinged base, the tower could be constructed on the ground. Most of the sections had to be "horsed" together with a bit of grunting, but this made for a tight fit. The next step was attaching the coaxial cables and rotor wire. The cables should be placed on the inside of the tower so that they are not damaged on future climbing of the tower. This job was neatly accomplished thanks to Phelps-Dodge "Straptite" cable clamps.[3] The antennas, a commercial 8 element 2 meter yagi and an 11 element 220 MHz beam, were previously assembled on the mast and attached to the rotor at the top of the tower. A monitor-scanner antenna was side mounted on the tower completing the installation.

All of this work, however, was not without the curse of Murphy. In the process of making jumper cables between the antennas and feedlines, it was found that no one had had experience in attaching "N" connectors to RG/8 polyfoam coax. Well, as it turned out, it is almost impossible to do. Regular RG/8, no problem; polyfoam RG/8, forget it. A quick call to W2VAQ solved the jumper problem and saved the day.

The third, and most crucial, phase was now to be done – erecting the tower. Though we did not really expect it, raising the tower proved to be the biggest task of the day. Mathematically, the tower was only supposed to weigh 844 pounds at its lowest level to the horizon. This was calculated using the formula shown below, where H1 = Height from pivot point to rope attachment on tower, in feet; L1 = Length from pivot to pulling point, along horizontal, in feet; Wa = Weight of antennas, rotor, etc., in pounds; Wt = Weight of tower including cables, in pounds; A = Angle tower makes with horizontal, in degrees; H = Height above pivot point of rope pulling tower, in feet; L = Length of tower, in feet; T = Tension in rope, in pounds; and the following are assumed: 1. Weight of tower is uniform over entire length; 2. Weight of antennas, rotor, etc., is at top of tower; 3. No friction is involved anywhere.

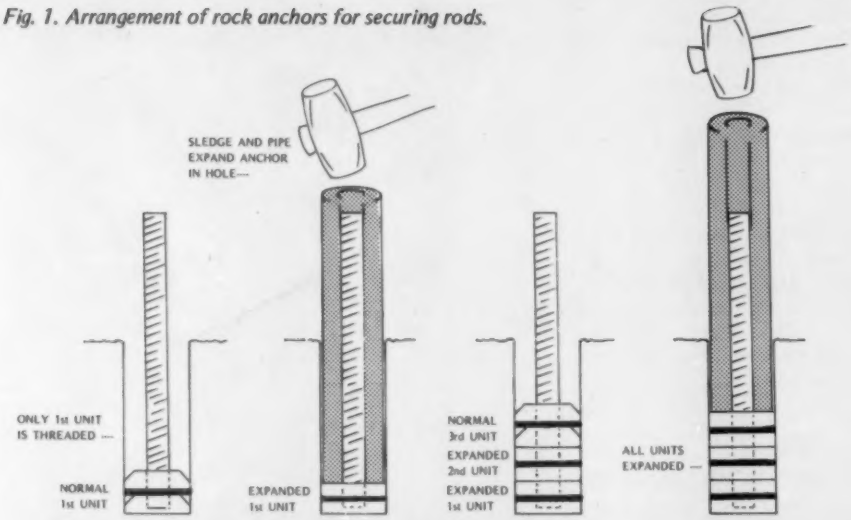
$$T = \frac{L \times [\,(Wt / 2) + Wa\,] \times \text{Cos } A}{H1 \times \text{Sin } A - \text{Arc Tan } [\,(H1 \times \text{Sin } A) - H)\,] / (H1 \times \text{Cos } A + L1)}$$

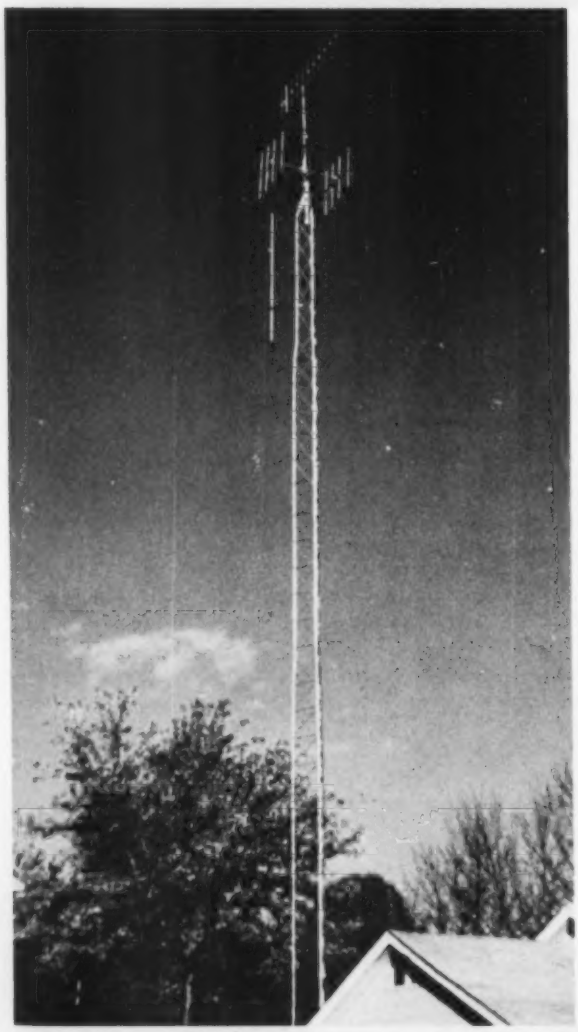
Connectors were installed on cables at the base of the tower and attached to the outside bulkhead.

In actuality, the tower seemed to weigh a great deal more. Despite the distinct advantages offered by the formula parameters "L1" and "H" – the rope being thrown over the house giving excellent elevation and fair distance from the tower base – the job proved to be a real doozy. Three robust amateurs – WB2COY, WB2CTH, and WB2HDS – were on the ropes while two other hefties – W2BEV and WA2QWP – walked the tower up. A double strand of 1/2 inch hemp proved barely sufficient – discovered, of course, about half way through the raising. Nevertheless, after much pushing, pulling, and puffing, up she went – vertical at last. With a sigh of relief, all broke into big smiles and exclamations of joy over a job well done.

BUT . . . but, all was not well. Murphy had other plans. Just a moment after the tower settled to the vertical position, a reflector element in one of the 2 meter beams slipped from its socket and fell to the ground. Luckily no one was injured, but after many hours of work this was

Fig. 1. Arrangement of rock anchors for securing rods.





The completed tower.

a most discouraging end to an otherwise fruitful day.

A few days later, upon recovering from the dropping reflector, WA2BXK climbed the tower and installed the offending rod. In the meantime, connectors were installed on the cables at the base of the tower and attached to the outside bulkhead. See photo.

As can be seen from the photo, all coax lines are fed through the side of the house via the bulkhead. The bulkhead consists of a piece of 1/8 x 2 1/2 x 5 inch aluminum plate with four double female "UHF" connectors. Type "N" would probably be better, but I could not find any locally. The interior surface of the outside bulkhead was coated with a cloth-like material similar to that which is used on water pipes to keep them from "sweating." There is a second such bulkhead on the inside wall. RG/8 jumpers between the wall connect the two bulkheads. The five-wire rotor cable is attached in a like manner, but standard male/female mike connectors are used.

Though such an arrangement contains numerous connectors, it has its distinct advantages. Should the tower have to be lowered, the cables can be easily disconnected/connected. Also, all lines can be quickly disconnected during thunderstorms. To complete the installation, both the tower and outside bulkhead are bonded together with No. 4 copper which is then run to ground — in my case, to a sixty-five foot well casing.

Finally, with all of the connections made, power was applied to the 2 meter antenna. And as you might guess, Murphy struck again. The initial swr was a horrible 2.25:1. To make a short story longer, the jumpers between the bulkheads proved to be the problem. Polyfoam RG/8 struck once more. Though there was "meter" continuity between the jumpers, not so for rf. Soldering the connectors to the coax caused minute bubbling of the foam which negated proper connection. A few more jumpers of regular RG/8, skillfully constructed by WA2BXK, and the problem was solved. The new swr was a respectable 1.38:1 over more than 1 1/2 MHz of the band. In conclusion, the antenna/tower project has proved very satisfactory. A northerly blockage with the old arrangement has been eliminated with the new tower. Direct 2 meter contacts with non-open (normal) band conditions have averaged more than 60 miles with full quieting reports. And, I can work all of the repeaters within the area — a radius of about 75 miles. Future plans call for a 15 meter beam and an 80 meter inverted "V". Many thanks to W2BEV, WZ2BXK, WB2COY, WB2CTH, WB2HDS, WA2HSF, WA2QWP, and W2VAQ as well as to WA1GFG/2 for the pictures. ■

Reference

[1] Amateur Electronic Supply, 4828 W. Fond du Lac Ave., Milwaukee WI 53216.

[2] Anchor Alloys, Inc., 966 Meeker Ave., Brooklyn NY 11222.

[3] Phelps-Dodge Communications Co., Route 79, Marlboro NJ 07746.

ME-3 microminiature tone encoder

Compatible with all sub-audible tone systems such as: Private Line, Channel Guard, Quiet Channel, etc.

- Powered by 6-16vdc, unregulated
- Microminiature in size to fit inside all mobile units and most portable units
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- Available in all EIA tone frequencies, 67.0 Hz-203.5 Hz
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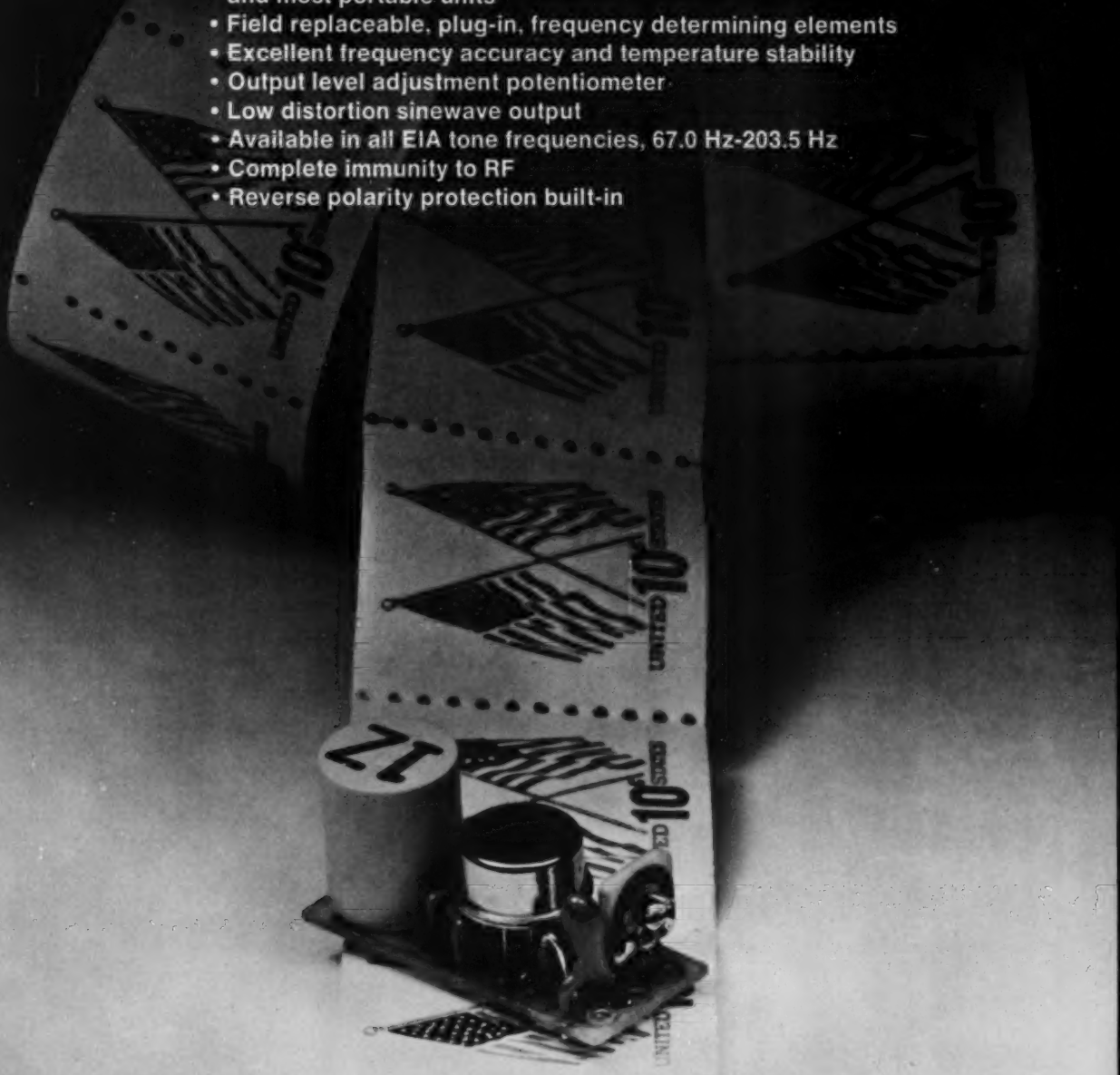
- Reverse polarity protection built-in



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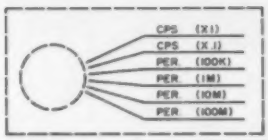

Fig. 1. Range switch scales.

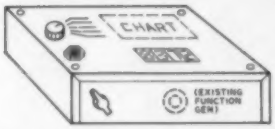

Fig. 2. Oblique view showing general outward appearance.

John C. Savage W4JYW
3115 Avenue U, N.W.
Winter Haven FL 33880

The Speedy Audio Counter

- - good resolution without a long wait

The need for fast and accurate measurement of the low frequency tones in an electronic organ provided the basic drive to produce this counter. An earlier version was slightly less costly, but far too slow and lacked the needed resolution. This design works well, and should find acceptance with those wishing for precise measurements for most audio frequency applications.

Most electronic organs contain a master oscillator board that uses 12 slug-tuned coils for generating the highest tones, or the top octave. These are followed by a divider chain that provides successively lower octaves. It was decided to measure one of the lower octave ranges that spans from C6 at 1046.50 Hz to C5 at 523.25 Hz. With a conventional counter, a ten second gate would provide tenths of Hertz resolution at best, and a longer gate time is out of the question. The only reasonable approach is to count the number of higher frequency pulses that occur during one or more cycles of the frequency being measured. For example, if the number of one microsecond pulses were counted during one cycle of A5 at 880.00 Hz, you would get 1136. A ten cycle count gives 11363, and 100 cycles will read 113636. The period of one cycle of A5 is .00113636 seconds, so 100 cycles requires just over .1 second. You get the required resolution and fast update to the counter. To calculate the required display reading, just divide the reference frequency by the input frequency in Hertz.

A look at Fig. 4 shows that CMOS integrated circuits are used throughout. A four stage display counter consisting of 4026s count and decode to seven segments in decade fashion. These were used in preference to 4033s, as they have a display enable input that permits us to blank the display while resetting or counting. No latches are used as it was found a "blinking" display is actually easy to use. A new display means an updated count. 4049s are used with 680 Ohm resistors for segment drive to MAN-1 readouts. Three 4518s are used for the timebase divider to provide 100 kHz pulses, or .1 second and 1 second timebases. A 4518 is also used to divide the input to give x1, x10, and x100 ranges. Two sections of a 4001 are used for the crystal oscillator and buffer, and two sections of another 4001 comprise the input amplifier. The input amplifier is biased slightly above or below the threshold point to prevent random triggering. A 4013 and three sections of 4001 are used to provide synchronization and division of the input, reset, display gating, and clock pulses to the counter chain. This gating system requires a minimum of parts, yet provides a 50/50 gate and display cycle. The reset is one-half cycle of the reference frequency that immediately precedes the count. As the 4026s require less than .5 usec for reset, it may be possible to use a higher reference frequency.

A two section, 6 position switch permits switching between the two count modes. Position A gives a direct reading in Hertz per second. Position B gates for .1 second. These two scales give a positive reference for gross tuning adjustments or quick identification of an unknown frequency.

Switch position C provides pulses at a 100k rate and D at a 1 microsecond rate. Positions E and F bring in the input

	FREQ	PERIOD
C 6	1046.50	.00095556
B 5	987.77	.00101238
A#5	932.33	.00107258
A 5	880.00	.00113636
G#5	830.61	.00120393
G 5	783.99	.00127552
F#5	739.99	.00135136
F 5	698.46	.00143172
E 5	659.26	.00151685
D#5	622.25	.00160707
D 5	587.33	.00170262
C#5	554.37	.00180384
C 5	523.25	.00191113

Table 1. A chart for organ tuning.

FREQ	PERIOD
1200	.00083333
1275	.00078431
1445	.00069204
1500	.00066666
1700	.00058823
1900	.00052631
2100	.00047619
2125	.00047058
2295	.00043572
2300	.00043478
2350	.00042553
2400	.00041666
2975	.00033613

Table 2. A chart for RTTY, SSTV.

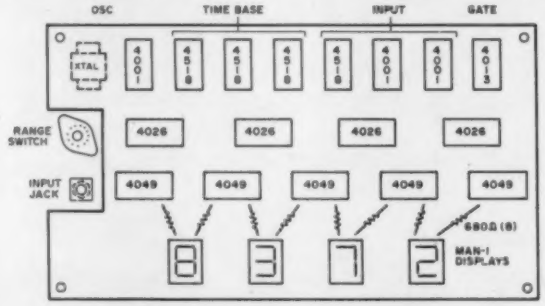

Fig. 3. Top view of component board.

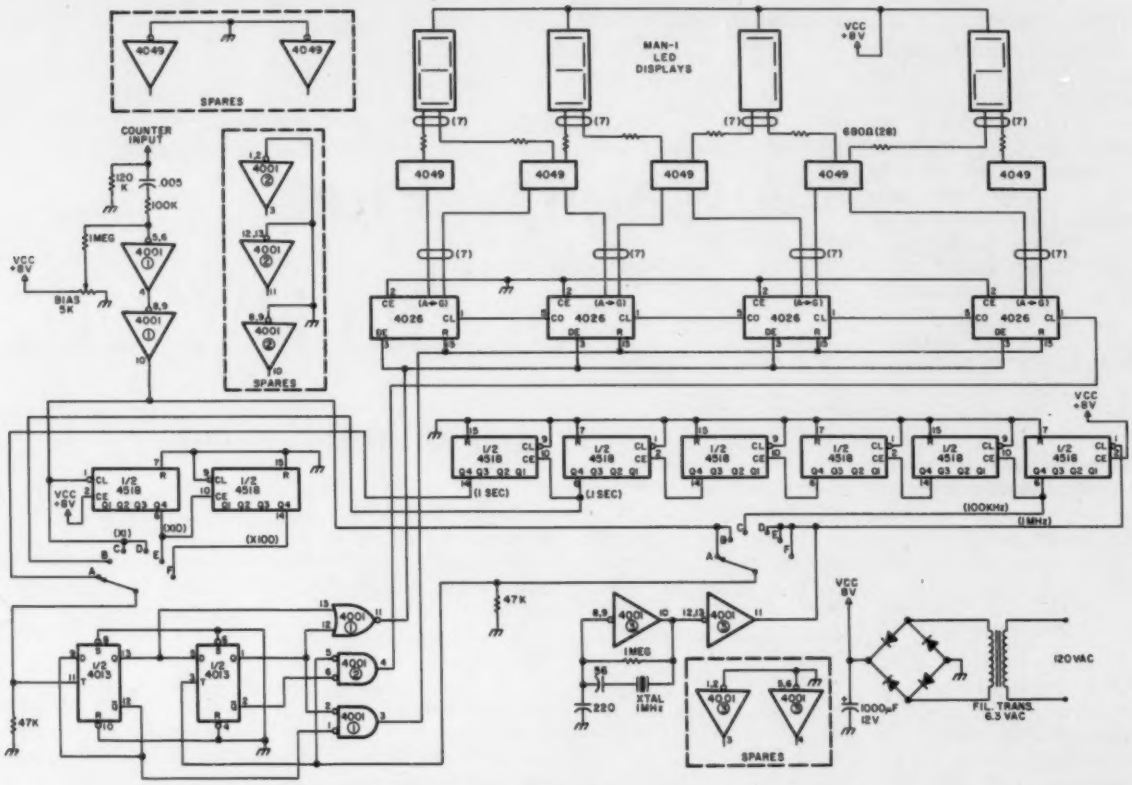

Fig. 4.

divider to give an effective x10 and x100 in resolution. An example of expected readings of A5 at 880.00 Hz would be: A – 0880, B – 0088, C – 0113, D – 1136, E – 1363 and F – 3636. The more significant digits drop off on the higher resolution scales, but it was felt that an overflow indication was not needed.

Construction was on a piece of perfboard with holes spaced .1 inch, mounted under the top cover of an existing function generator. The cabinet measured 7" wide, 5" deep and 3" high. The perfboard was slightly smaller with a section removed to permit the switch and input jack to be mounted on the top. The LEDs, ICs, and resistors were mounted on the top of the board, and point-to-point wiring used for connecting the components. The power supply is mounted on one end of the box. The crystal, originally from a BC-221 frequency meter, was removed from the metal cover and mounted on the board. If you have enough room in your cabinet, it would be better to leave it as is, and mount it with a clip or octal socket. A slot was cut out to reveal the LEDs and covered with plastic laminate for protection. A switch position scale and a chart of frequencies and their respective periods were typed up and pasted to the top, covered with more of the plastic laminate.

Sketches showing the general construction of the unit, and general layout of the circuit board are shown. A much more compact unit could have been constructed using printed circuit techniques, a two piece double-deck board, and substituting MAN-3 readouts which are smaller and would not require the 4049 segment drivers and resistors.■

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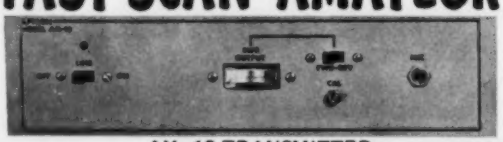

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Versatility Plus for the HW-202

-- extra channel mod

The HW-202 is a fine piece of 2 meter equipment, but six crystal pairs tend to limit the operation during travel periods. In any case, I could use a minimum of nine pairs. Six would be local repeaters and direct channels; three would be out of state or repeaters that are used during vacation, etc. I originally had the tone burst assembly installed in the HW-202, but the touchtone pad gives me all the inputs I need. Therefore, there is a nice space to put in a module the same size as the tone burst assembly, using the present mounting holes and front panel component holes. The switch module can also provide inputs for a synthesizer.

Circuit Description

Fig. 1 shows the circuit and it can be seen that it is a repetition of the circuits in the HW-202 except the inductive trimmers for the receive crystals have been left out. It was found that 90% of the receive crystals tuned at the same slug position.

The circuit shows seven crystal pairs and one switch position for synthesizer inputs. It is possible that additional crystals could be added because there is some space left on the board. There are three connections to be made to the transceiver circuits: receive crystal switch S1A to Y102 pin toward front of unit, transmit crystal switch S1B to Y202 pin toward left side of unit, and synthesizer key to pin 2 of mike jack. The circuit ground is accomplished by the mounting hardware in most cases. A wire ground can be made from bus shown on Fig. 2 to the lug on the speaker of the HW-202. These connection points are shown on a schematic on page 133 and circuit boards on pages 128 and 130 in the Heath Assembly Manual. Although Fig. 1 shows a 2 pole switch, a 4 pole, 4 section switch was installed so that if the crystals were excited during synthesizer operation, the extra two poles could be used to short out the crystal circuits.

The synthesizer inputs were included to make the circuit more useful. The transmit synthesizer input (T) could be used for an outboard crystal and easily adjustable netting trimmer in a small box. The receive synthesizer input (R) could be used for a vco or vfo input. The synthesizer key (K) is to energize the transmit vco by way of a relay.

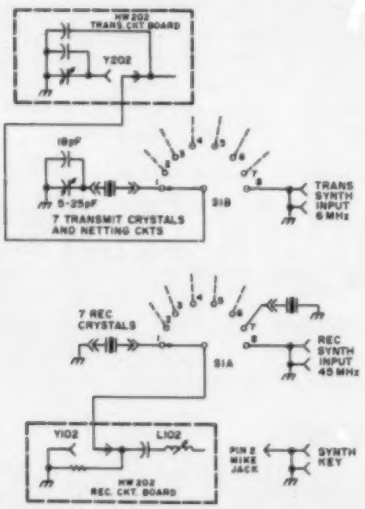


Fig. 1. Schematic of added crystal deck.

Mechanical

The module is built on 1/16" thick perforated board with .1 x .1 hole pattern. The mounting angle is made from 1/32" thick aluminum and can be bent very easily in a vise. This can be attached to the perforated board with brass rivets, eyelets or screws. Fig. 2 shows the assembly. The major dimensions are shown, as are general positions of components. All connections on the rear must be kept flush against the board or it will not fit in the HW-202. The miniature tube socket contacts or equivalent are pushed through the drilled holes and the tails bent flat against the board. Dummy crystals or substitutes must be plugged into the crystal contacts and all soldering done. The copper strip or bus ground will hold some of the components in place once it is soldered in place. Miniature crystal sockets could be used in place of the contacts shown, but must not protrude below the board more than 1/32 inch or make the height of the mounted crystal more than 5/8" above the board. The trimmer capacitors are also pushed through the drilled holes and the tails bent flush against the board. All wiring on the board was done with insulated no. 30 wire. The leads attached to the Heath circuit were no. 26. After all the soldering is done on the rear of the board, the component tabs, wire, and ground strip should be covered with Hysol Epoxy-Patch 0151 clear or equivalent, which will hold everything in place.

The wiring from the switch is routed near the crystals' top side, and then down through a convenient hole to the proper tail on crystal connector.

The front panel switch plate may be cut out and cemented to a 7/8" x 3-1/8" plate with 1/8" and 1/4" diameter holes for the switch and connectors. A thin plastic film should be laid over this for protection. Another way of fabrication is to make a clear film negative of the photo and apply to the plate using double faced clear tape. The surface of the aluminum plate should be brushed horizontally with sandpaper

previous to putting the film on for good appearance.

Installation

The disassembly instructions for the HWA-202-2 tone burst encoder on page 12 of the assembly manual should be accomplished. The crystal module can be attached in the same manner as the encoder, but use 4-40 flat head screws and standard lock washers and nuts. A thin piece of insulation should be placed between the crystal push-button assembly and the new module to prevent any shorts.

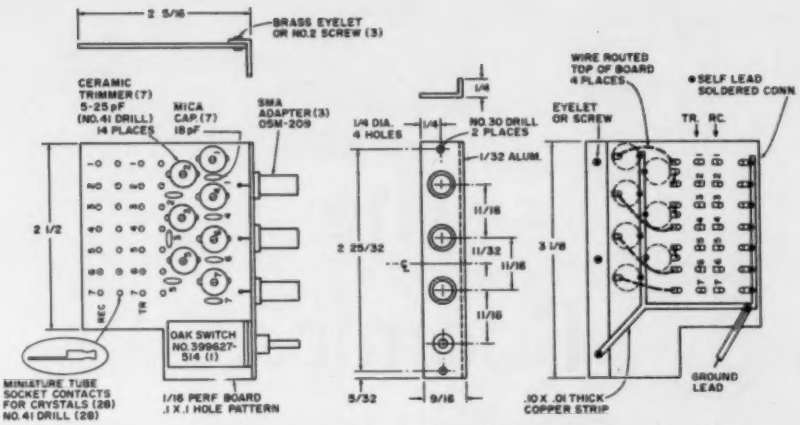


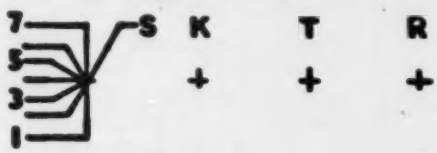
Fig. 2. Added crystal deck assembly for HW-202.

Adjustments

The receive crystal inductor L102 should be adjusted to average reception of all receive crystals in the new switch module. In my case, all crystals were very near, making an average setting easily accomplished. The transmit crystal trimmers will have to be adjusted using a counter or in the same manner as the other transmit crystals were trimmed.

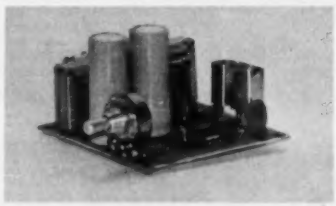
Conclusions

No trouble was encountered in the operation of the switch module. The additional crystal pairs made the Heath 202 much more useful as traveling equipment. Since the space on the front panel is limited, a switch knob that can be turned in the allocated space must be used. The knob must not be more than 1/2 inch diameter and at least 5/8 inch high. This allows a firm grip with two fingers. ■



Switch plate for front panel.

ADVA



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73 Magazine Staff

The Boomless Microbeam

-- works better than it ought to

Many methods have been tried to fold, load and twist the elements of 20, 15 and 10 meter beams to make them more compact while still retaining reasonable performance. No one can or should expect a compacted beam to work as well as a full size beam. Working "well" refers to forward gain, front to back ratio, low loss and low swr over a reasonable bandwidth. Designs have been made which optimize one factor at the sacrifice of all others. For instance, a beam might be determined and loaded to produce a low swr over an entire band, but usable gain might occur over only a very narrow portion of the band. Such a beam design might look good in advertising literature – "broadband, low swr, moderate gain" – but it really doesn't deliver much. On the other hand, not many amateurs would buy the beam if it stated "very low swr and high gain over any selected 50 kHz portion of a band."

Whether it is worthwhile to go after a compact beam (either commercial or home brew) for a few extra dB obviously revolves around the cost and effort involved. Sometimes the few extra dB aren't as important as adding some directivity to the antenna system to improve the reception side of things. This sort of evaluation has to be made for specific circumstances. But, one can't make it without good details on what one is building or buying.

The boomless 2 element beam described in this article is not a cure for all problems, although variations of this design have successfully been used for over 10 years by various amateurs. Rather than make sharp compromises in any one direction, the main advantage of the design is that it makes moderate, acceptable compromises in several directions. It has a gain of several dB across a given band, the swr is low (2:1 or less) across a band, and the front to back ratio is a usable 10-15 dB across a band. Also, and perhaps most importantly, it is simple to construct. The electrical layout of the beam is shown in Fig. 1. It consists of a driven element and a director element. A reflector element for the parasitic element might produce somewhat more gain. But at the close element spacing used, a director element has only about 1 dB less gain and produces much better overall front-to-back ratio properties. The beam dimensions are as shown for 20 meters and can be scaled down or up for other bands. The dimensions have been arrived at empirically by those who have built this type of beam and seem to yield the best overall average results. Because of the loading effect produced by folding back the elements, their overall lineal length is greater than that found in full size beams, although overall the beam is much more compact than a full size beam.

The driven element is not shown separated for connec-

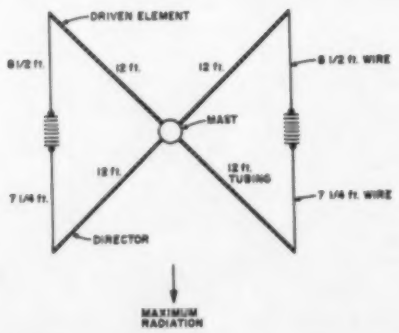

Fig. 1. Basic beam dimensions for 20 meters.

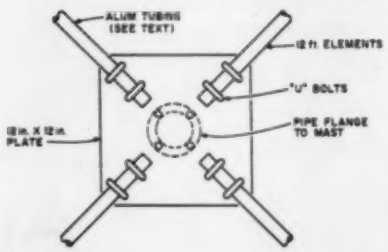

Fig. 2. Mast mounting plate.

tion to a transmission line. It could be separated in the center and fed directly, preferably through a 1:1 balun, with 50 Ohm coaxial line. The match should be a good one, producing a low swr without any matching devices. The director element is left as shown.

Feeding the antenna in the preceding manner requires, however, that the two sides of the driven element coming towards the mast be insulated from the mast. Simplified plumber's delight construction can be achieved by having all of the antenna elements coming towards the mast grounded to the mast and the driven element feed via a gamma match. Various construction techniques can be used for the purpose depending on the tools and equipment available. Fig. 2 shows one simple method which does not require any special tools. An approximate 12 by 12 inch aluminum or steel plate is used with a pipe flange which fits over the mast. Of course, it would be best if a steel threaded mast could be used. The antenna elements are nested aluminum tubing starting with 8 foot lengths of 1¼" OD aluminum. These are secured to the square mast plate by means of two U bolts on each element. The total length of 12 feet for each element is made by nesting 4 foot tubing into the 8 foot sections. Tubing clamps are used to secure the sections together. Alternatively, the 12 foot elements of aluminum are locally available. The rest of the antenna is made of #12 wire strung between the tips of the 12 foot sections. Nylon clothesline (the type without metal reinforcement) makes a good, simple insulator between the wire sections.

There is no tuning to the antenna other than matching the transmission line to the driven element. One could experiment with tuning of the driven and director elements by varying the length

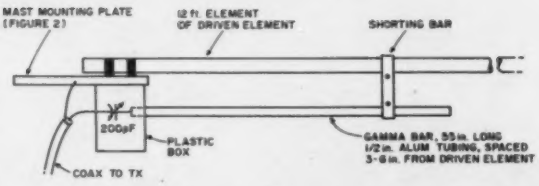
MAST MOUNTING PLATE (FIGURE 2)
12 ft. ELEMENT OF DRIVEN ELEMENT
SHORTING BAR
200pF
PLASTIC BOX
GAMMA BAR, 55 in. LONG 1/2 in. ALUM TUBING, SPACED 3-6 in. FROM DRIVEN ELEMENT
COAX TO TX

Fig. 3. Gamma match to coaxial transmission line. The gamma bar can be placed on either of the two 12' driven element members shown in Fig. 1.

of the wire sections of each element, but it is doubtful if any better performance would be achieved. Transmission line matching is done most easily with a gamma match as shown in Fig. 3. A 55" length of ½" aluminum tubing is run parallel to one 12 foot leg of the driven element at 3-6 inch spacing. It is supported at one end by a metal shorting clamp to the driven element, and at the other by the housing of a plastic box which contains a series 200 pF variable. The plastic box is mounted on the bottom of the mast plate and can be supported by the U clamps which hold the 12 foot elements down. A sturdy plastic kitchen food container can be used for the enclosure where severe weather is not a problem. Otherwise, a solid plexiglas housing is needed. The metal shorting clamp is moved along the driven element a few inches at a time and the variable capacitor tuned for each setting until the lowest swr is achieved on the line. The beam should be in its final operating position or as high off the ground as practical while making this adjustment.

Any medium to heavy duty TV type rotator will suffice to handle the beam antenna. ■

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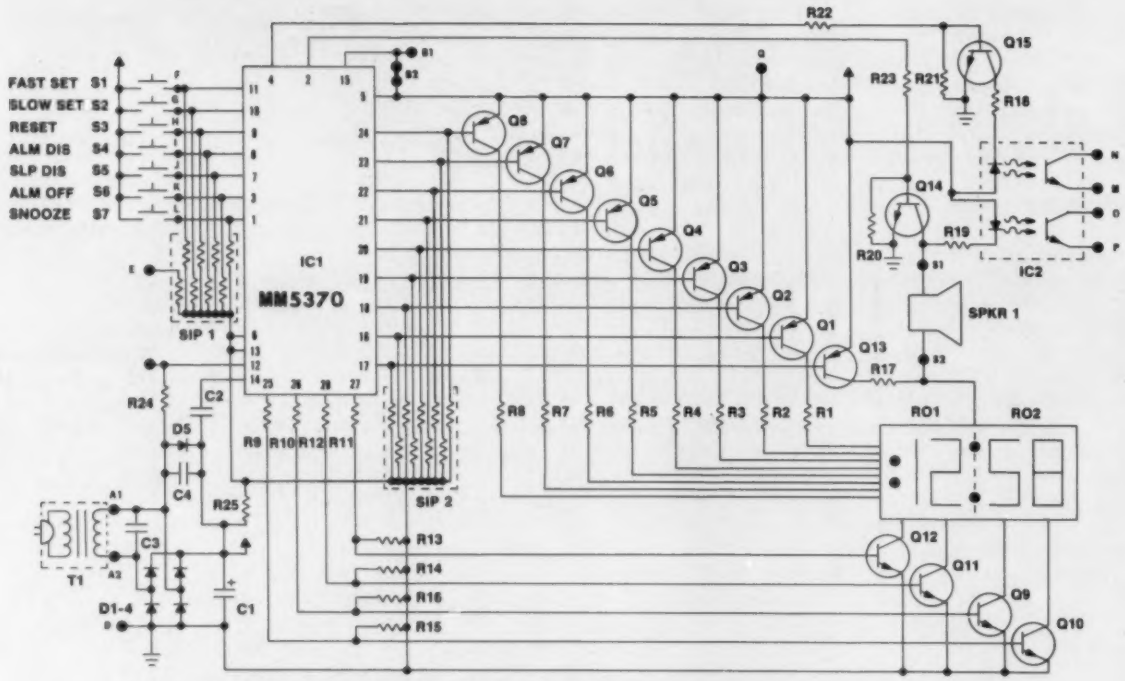


Fig. 1. Schematic diagram of the four digit clock used for illustration in this article.

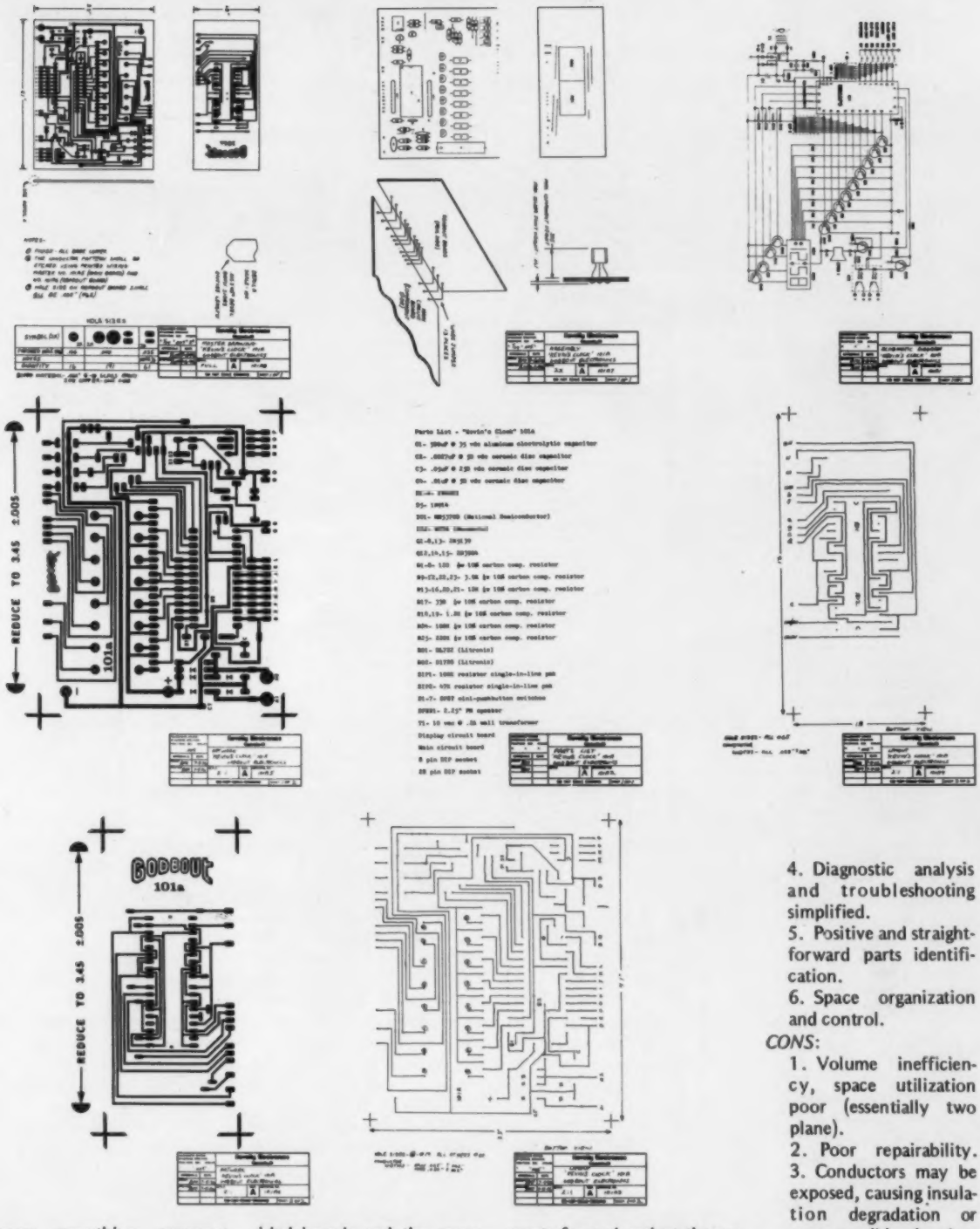
Charles F. Smith
c/o 73 Magazine

Making Your Own PC Boards

- - part I

There have been quite a few construction projects in magazines lately, some without printed circuit board artwork. Oftentimes, with a simple project, a PC board is unnecessary. However, when a project starts using a lot of components and gets complex, it is usually much easier to use a board. This does not apply only to magazine projects. Home brew ideas will have a neater, more professional look if a circuit board is used.

This is the first of a two part article dealing with the design and manufacture of printed circuit boards. It will



cover everything necessary for the home experimenter to produce high quality, professional-looking boards. This part of the article will deal with documentation and production of artwork for a single-sided board. Next month we will cover double-sided boards and the manufacturing process.

While the use of a printed circuit board is generally a good idea, there are times when a second thought is advisable. As with any good thing, a PC board has its disadvantages. Some arguments for and against the use of printed circuit boards are as follows:

PROS:

1. Weight reduction as much as 10 to 1.
2. Designed in performance.
3. Ease of inspection.
4. Diagnostic analysis and troubleshooting simplified.
5. Positive and straightforward parts identification.
6. Space organization and control.

CONS:

1. Volume inefficiency, space utilization poor (essentially two plane).
2. Poor repairability.
3. Conductors may be exposed, causing insulation degradation or even possible shorting.
4. Thermal design complicated and limited.
5. Design regimentation and restriction, with electrical and mechanical compromises.
6. Circuit revision dif-

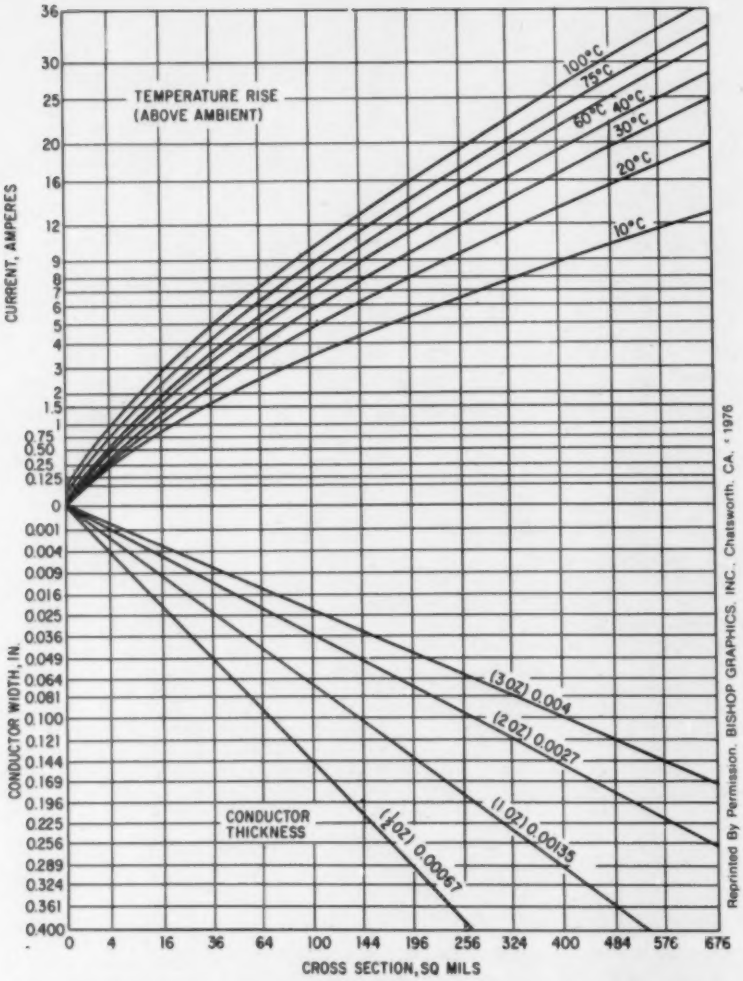


Fig. 3. Use this chart to find minimum conductor widths for the circuit board.

ficult and sometimes impossible.

Single-Sided or Double-Sided?

When you do decide to use a circuit board, you should be aware of what is available. Currently, there are four different types of printed circuit boards you can use. These are single-sided, double-sided, multi-layer, and flexible. The single-sided board has all of the wiring on one side, with the components on the other side. The laminate serves as an insulator and support. The double-sided PC board has the bulk of the wiring on the bottom, with the remainder on the top side. Components are generally mounted on the side with the least amount of wiring.

A multi-layer board is composed of many very thin boards laminated together. Sometimes as many as 19 individual layers may be found in one multi-layer board. The home manufacture of this type of board will be discussed along with double-sided boards next month.

The last type of board in common use today is the flexible circuit. Very simply, this is a single- or double-sided board using a paper thin laminate. An example of their common usage can be found in the dash of many newer automobiles.

With a selection like that to choose from, which type of board do you pick for a particular application? Choosing is really very simple. Multi-layer and flexible circuits are the most difficult for the home experimenter to manufacture, so they are out. We are left with a choice between single-sided and double-sided boards. Single-sided is the least expensive, but can be a headache to design if the circuit is complicated. Double-sided boards offer more flexibility in design, but are a bit more expensive.

Look at the circuit you are going to design a board for. Is it complex? Does it use a lot of integrated circuits? If your answer is yes, you may want to use a double-sided board. If your circuitry is fairly simple and/or straightforward, you may want to use a single-sided PC board. This month we are going to design a single-sided PC board for the digital clock in Fig. 1.

Documentation

When you have decided to make a printed circuit board, the first thing to check is whether you have adequate documentation. This would be a schematic or logic diagram, a parts list, and any other pertinent data. This step is important, whether you are going to make a one-of-a-kind prototype or a production run of a few hundred or more. Good documentation helps prevent mistakes that may occur later in manufacturing. An example of documentation is shown in Fig. 2.

When drawing your diagrams, there are some points to remember. Signal flow should be drawn from the left to the right, with the inputs on the left, the outputs on the right. The highest voltage potentials are normally drawn toward the top, the lowest

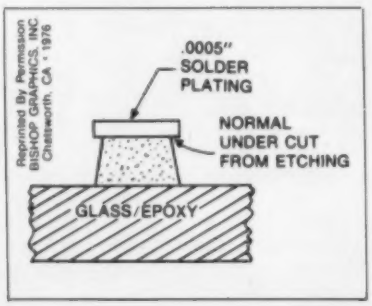


Fig. 4. Conductor edge undercut.

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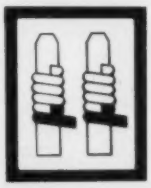

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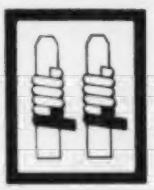

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	MIL-STD-275C	IPC-ML-910
0 to 9	.025" (0.64 mm)	.015" (0.38 mm)
10 to 15		
16 to 30		
31 to 50		.025" (0.64 mm)
51 to 100		
101 to 150		
151 to 170	.050" (1.27 mm)	
171 to 250		
251 to 300		
301 to 500	.100" (2.54 mm)	
500+	.0002 in/volt (0.0051 mm/volt)	

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Table 1. Conductor spacing.

toward the bottom. Support circuitry is drawn on the lower half of the drawing. These are oscillators, power supplies, and other circuits not included in the main drawing. An exception to this rule is when it is easier to include a support circuit in the main diagram.

It is not necessary to follow these rules. However, most drawings tend to follow them, and standardization helps reduce possible confusion and problems later on.

When drawing a schematic diagram, it is a good idea to draw it in such a way as to keep crossovers to a minimum. This drawing is what you will be using to lay out your board. Crossovers on a PC board represent electrical connections. This will become more clearly understood when the layout has begun. A typical schematic diagram for a four digit digital clock is shown in Fig. 1.

Layout Design

The printed circuit board layout is the necessary step between the schematic or logic diagram and the master artwork. It should contain all of the circuit board design information. The component locations, interconnecting circuitry, and board outline should all be included, drawn to scale. The scale used, hole and conductor sizes, as well as all measurements, should be noted external to the board area.

The use of a grid system when doing a board layout is important. Most electronic parts are spaced on a 1/10" grid.

A grid is a "two-dimensional rectangular network consisting of a set of equidistant parallel lines superimposed upon another set of equidistant parallel lines with one set of lines perpendicular to the other." (Bishop Graphics) The most common grids, at actual board size, in use today are .100", .050", and .025" in order of preference.

All board artwork and layouts should be done at an enlarged scale. Errors in pad and conductor alignment and imperfections in drafting aids will be reduced proportionately with the reduction of artwork to finished board size.

The scales most often used for layouts are 2x, 4x, and 1x, in order of preference. 1x should always be avoided except in cases where reducing facilities are not available.

When designing a PC board, careful thought must be given to conductor width and spacing. If a conductor is too small, discontinuity may result. On the finished board, consideration must be given to possible heat problems. Narrow traces will lift off very easily. Their added difficulty in manufacturing will result in an increased cost. Narrow spacing is also difficult to manufacture and may cause short circuits. Widths and spacings that are too large may result in wasted valuable board space.

Conductors larger than .500" should be avoided. If larger conductive areas are needed, as in the case of ground planes, they should be relieved to avoid blistering or warping during soldering. More information on ground planes will be discussed later.

Conductor width should be determined by the required current carrying capacity. Width may be selected by referring to Fig. 3. Spacing is determined by the voltage present, and whether the board has been coated or not. If narrow spacing is used around high voltage, arcing may result. Table 1 shows suggested conductor spacing determined by voltages present. Typical spacing of .031" or .050" is suggested for low

AWG		FINISH HOLE	RECOMMENDED 2X TERMINAL AREA	COMPONENT
34	.0063			
33	.0071			
32	.0080	.0145		
31	.0089	#79 drill	.150	
30	.0100			
29	.0113			
28	.0126			
27	.0142			
26	.0159	.0260		
25	.0179	#71 drill	.170	1/8 Watt resistor, DIP, TO-5, TO-18
24	.0201			
23	.0226			
22	.0253	.0360		
21	.0258	#64 drill	.187	1/4 Watt resistor, TO-220, TO-202
20	.0320			
19	.0359	.0520		
18	.0403	#55 drill	.218	1/2-2 Watt resistor, TO-3
17	.0435			
16	.0508	.0625		
15	.0571	1/16, #52 drill	.250	

MACHINE SCREWS

SIZE	CLEARANCE	HOLE	RECOMMENDED SCREW	2X TERMINAL WASHER AREA
2	#44	.086	.312	.468
4	#33	.113	.437	.650
6	#28	.140	.531	.800
8	#19	.166	.600	1.000
10	#11	.191	.687	1.000

Table 2. Pad sizes. Note: All measurements shown in inches.

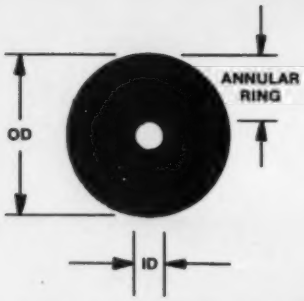

Fig. 5. Annular ring in detail.

voltage applications when space permits. Conductors should be placed no closer than .100" to .250" to a board edge or mounting hardware.

When the PC board is etched, a small amount of copper will be removed from underneath the resist or plating. This should be taken into account when selecting a conductor width or pad size. With larger conductors, this undercutting can be considered irrelevant. However, when using narrow conductors (approximately .015" and smaller), if great precision is required, add one or two thousandths to allow for this. See Fig. 4.

Pad Sizes

Choosing pad sizes is much the same as choosing conductor widths. Instead of width, however, we have what is called annular ring to think about. Annular ring is (OD-ID)/2, where OD is the pad outside diameter and ID is the hole size. See Fig. 5.

There should be a separate pad and hole for each component lead or connecting wires. Hole exceptions are made for components in a "flat-pak" configuration.

Pads should be as large as practical while maintaining minimum spacing requirements. Table 2 lists suggested pad sizes for common components.

Oftentimes mounting holes as well as component leads will have pads. When using a pad for a mounting hole, make the pad as large or larger than the screws or washer that will contact the board. In this way, when taping up the master artwork, you will have a better knowledge of where nearby conductors may be placed.

A ground plane is an area of the circuit board used as a common point between many connections. This is usually the ground of the power supply, hence its name. Rather than being a narrow conductor from one point to another, a ground plane is a large area of copper. These are often used as supply buses or shielding, especially in high frequency circuits. Ground planes are sometimes used for heat sinking, although their use for this application is somewhat limited.

When laying out a ground plane, approximately fifty percent should be relieved to prevent blistering and a heat sinking effect during soldering operations. Fig. 6 illustrates two common methods of relieving the copper. An exception to this rule could be when the ground plane is designed to be a heat sink. Under these circumstances, the idea is to have as much copper exposed as possible.

For connections to the ground plane, special pads are suggested. These are detailed in Fig. 7. A clearance is provided between the terminal area and ground plane. Where continuity is desired between the pad and the ground plane, two to four connections are made. This helps prevent a poor solder connection resulting from the heat sinking problems discussed earlier.

Special Considerations

Designing a circuit board is not always as easy as it may sound. Very often, a circuit will have many special problems to consider. Feedback, noise popping up where it should not, and uneven propagation delays in digital circuits are only a few of the many unexpected problems that may occur in the finished product if the board is not designed with thought. Conductor routing on a PC board is basically the same as wiring a circuit point to point. The same care must be taken when designing a PC board.

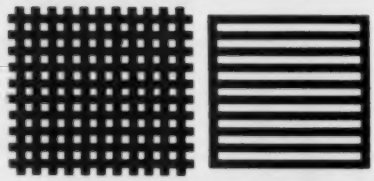

Fig. 6. Methods of relieving copper for ground planes.

When a board is designed and feedback could be a problem, you can run a ground line between the sensitive section and the area most likely to cause interference. Fig. 8 illustrates this with a few typical problems. Some other problems to watch for are high voltages, currents, or frequencies. Heat distribution may also create a headache. Be sure that heat sensitive parts are kept away from power devices.

When drawing a layout, it should be drawn looking at the bottom of the board – that is, from the foil side. This can become confusing at times, but there is a good reason. The master artwork is copied directly from the layout. When the artwork is photographed, you will want a negative with the emulsion side facing the board. The exception is when the board is to be silk screened.

As bad as this may sound, doing a layout in this manner is not really hard. All you have to remember is that everything is drawn upside down. After a while, drawing like this will become second nature.

To do a layout, you are going to need the following materials: some tenth inch graph paper, black and red pencils, and an eraser.

The graph paper should be a precision type, printed on stable material for accuracy. If the board you are going to make does not require extreme precision, any tenth inch graph paper will do.

Layout Design Techniques

Before beginning your layout, find an area in the schematic where a group of components share a common point. Draw these parts on the grid by drawing a dot where each lead will go. To avoid confusion later, the symbol or part number is drawn where the component will go. Once you have the parts drawn in, draw the interconnecting lines between the dots (pads). If the schematic diagram has been

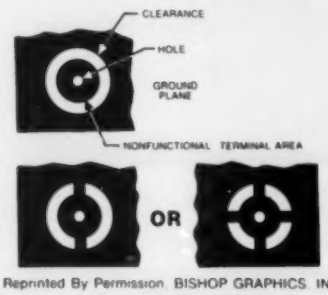

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Fig. 7. Special pads for ground planes.

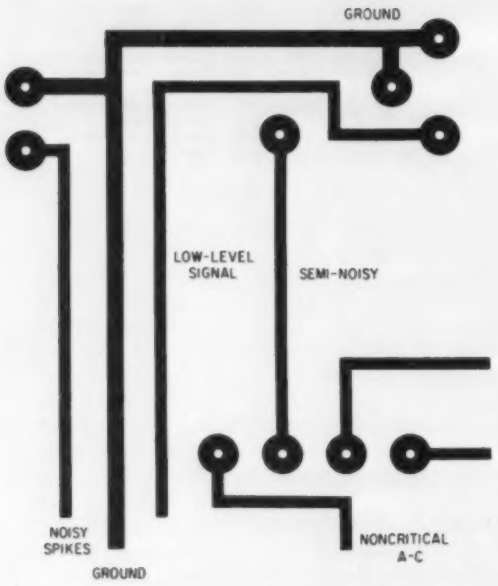

Fig. 8. Typical layout problems and solutions.

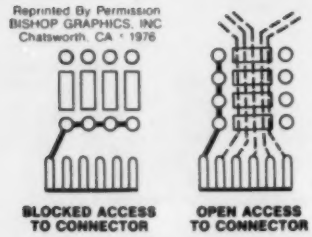

Fig. 9. Arranging parts to provide maximum access to other components or edge connectors.

drawn with as few crossovers as possible, this step will be very easy. Places where crossovers exist on the schematic may be remedied by remembering that conductors may be placed under parts and between pads. An alternate but very similar method is to lay out the board basically the same as the schematic has been drawn.

Other methods of layout design include choosing one or more multi-lead components and radiating outward from them. This is what was done with the four digit clock in Fig. 2. When using a connector, or pads for external wiring (inputs, outputs, or external parts), locate these pads first. Sometimes it is easier to do this and radiate components inward.

When laying out a board, care should be taken to keep a neat and orderly appearance. Components should be positioned to provide maximum access to other parts. See Fig. 9.

On a single-sided board, it is possible, and very likely if the circuit is complex, that you will have a crossover or two. Maybe even a few more. However, crossovers on a circuit board represent short circuits and so are not allowed. To remedy the crossover situation, we use jumpers. A jumper is a wire placed on the component side of the board to "jump" over conductors on the bottom. These should be treated as separate components. That is, they occupy space and need two holes. When a jumper is drawn on the layout, use a different color pencil to indicate placement. This helps prevent putting parts under or over a jumper wire.

After the layout is finished, carefully check it over for mistakes. Accuracy here is very important. The master artwork, and hence the board, will reflect everything on the layout. Unless you are in a hurry, it is sometimes best to let the layout sit overnight before checking it. It is surprising how many times you may overlook a mistake.

To elaborate further on layout design, I will use Fig. 10 as an example. This layout

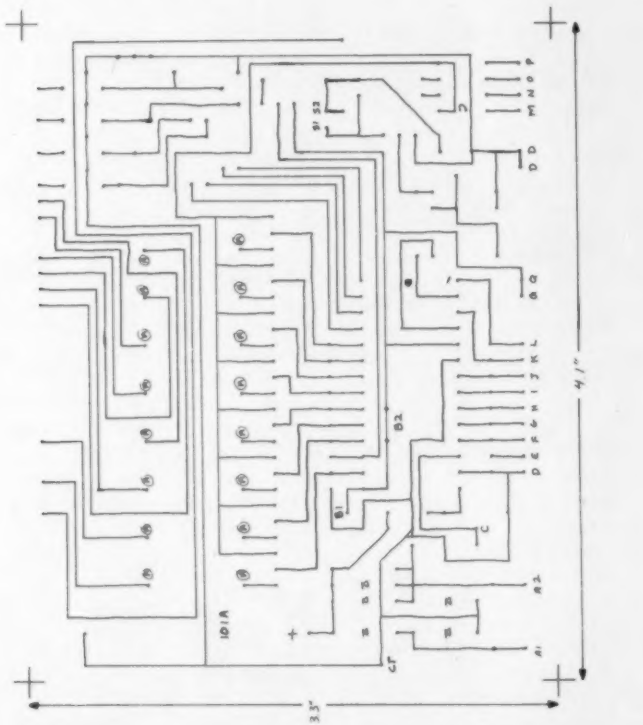

Fig. 10. Finished "main board" layout for the clock.

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was drawn from the schematic diagram in Fig. 1.

Briefly, here are the steps that were taken. IC1 is the main component and also the one with the most connections. Very conveniently, the switch inputs are all on one side. This helped decide its position and placement. Pull down resistor packs SIP1 and SIP2 were placed directly opposite the segment and digit enable outputs. (The guys who decided the IC pinout sure did a nice job.) The next things to lay out were the segment enable transistors and limiting resistors. The distance the transistors were placed from SIP2 was calculated figuring the use of .050" tape (.025" conductors on the finished board). Four conductors would have to be run parallel to the IC. I counted up two tenths from SIP2 and drew my first line. Using the tenth inch graph paper as my guide, I drew three more lines one tenth inch apart. This gave me .025" conductors with .025" spaces on the finished board. Allowing two tenths again for spacing between conductors and pads, I now had the spacing needed between the SIP and the transistors. With this in mind, I centered the transistors above the SIP .350" away from it. Unless otherwise noted, by the way, these figures are layout size (2x) rather than actual board size. The rest of the segment enable parts should be self-explanatory.

Digit enable was a bit more difficult. I knew approximately where the board edge was going to be, so I worked backwards from there. The transistors were set up kind of funny because I did not want to cut or use narrow pads. This clock was designed for a kit, and large pads make it easier to assemble. I also did not want to use any jumpers here. Anyway, if you look closely at the layout, you can see basically what I did. I just worked downward, placing pull down resistors where needed as I went. After these, I put the series resistors in using the same method.

The power supply was fairly straightforward, and should not need any explanation. Perhaps the most difficult was the section with the optoisolator (IC2). Basically, I just put the parts where they would fit. The optoisolator fit conveniently in the corner. It also has four outputs that I wanted at that edge. The rest of the circuitry in this section can be best explained by careful examination of the layout. The readout board will not be explained here because of its relative simplicity.

Artwork Design Techniques

Before you begin taping the artwork, familiarize yourself with the different methods available. These include pen and ink, "rub-ons," drafting tape and preprinted "stick-ons."

With the pen and ink method, everything is drawn by hand on drafting vellum or directly on the blank board. This method is unreliable and produces inferior quality artwork. Therefore, its use is not recommended.

Rub-ons are symbols with gummed backing preprinted on a plastic base material. These are used by positioning the symbol over the area desired and rubbing the backing with a blunt instrument until the symbol comes off. This method is usually used on a blank board. Results are sometimes impressive, but you end up with a one-of-a-kind board. A problem common to rub-ons, however, is cracking. This produces broken conductors, split pads, and the like.

The last and by far the best method is using tape and preprinted stick-ons. This is the most common, and produces the best looking boards in the end. Stick-ons may be purchased in a large variety of configurations, with patterns available for almost all types of electronic components.

Using this method, die cut pads and stick-ons are positioned on mylar in positions dictated by the layout. Connections between components are made with precision slit artwork tape. This tape comes in standard widths from .015" to 6" ±.002" in both metric and decimal sizes. Preprinted stick-ons are also manufactured to a tolerance of ±.002".

With everything else out of the way, it is time to tape up the artwork. You are going to need artwork materials: tape and stick-ons as mentioned earlier, a razor blade or X-acto knife to cut the tape, and some drafting film. The easiest to use is mylar with a matte finish on one side. All of these things are available from Bishop Graphics in Chatsworth CA. A light table will make it easier to lay out the artwork, but it is not absolutely necessary.

There are two ways to do artwork. One is with straight lines and sharp corners. The other way has curved lines and corners. The only problem with this method is that the draftsman must be somewhat artistic. If he is not, it is possible to end up with messy-looking artwork. Using the square corner method is preferred, but it does have a drawback. When etching, you have to watch out for undercutting at the corners, though careful planning and design can take care of this.

Now you are ready to start. Finish off that cup of coffee you have been drinking, and go wash your hands. Soft drinks and food are also forbidden while taping the artwork. Believe me, the last thing you want to do is accidentally spill something on half-finished artwork. The reason for clean hands should be obvious. Fingerprints and smudges can also help ruin otherwise good artwork.

The easiest way to produce artwork is to place the layout directly underneath the mylar and tape directly over it. Another way is to

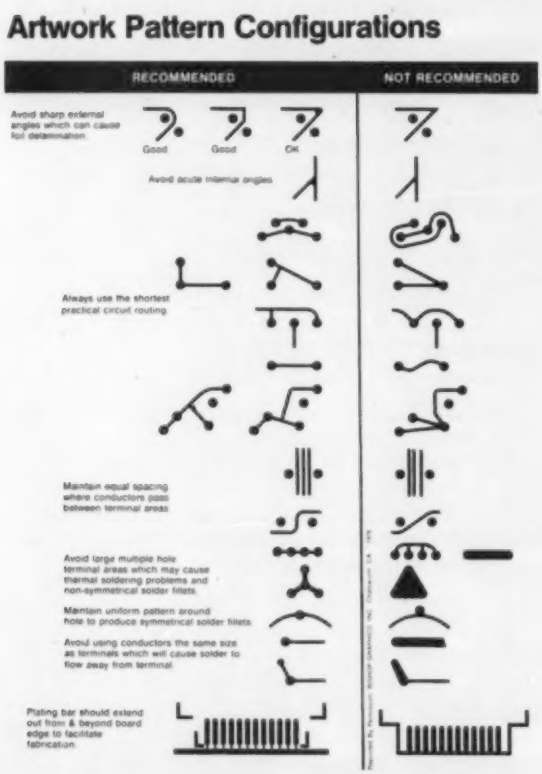

Artwork Pattern Configurations
RECOMMENDED
NOT RECOMMENDED
Avoid sharp external angles which can cause foil delamination.
Good
Good
OK
Avoid acute internal angles.
Always use the shortest practical circuit routing.
Maintain equal spacing where conductors pass between terminal areas.
Avoid large multiple hole terminal areas which may cause thermal soldering problems and non-symmetrical solder fillets.
Maintain uniform pattern around hole to produce symmetrical solder fillets.
Avoid using conductors the same size as terminals which will cause solder to flow away from terminal.
Plating bar should extend out from & beyond board edge to facilitate fabrication.

Fig. 11. Dos and don'ts for taping artwork.

place a piece of precision graph paper under the mylar and transfer the pattern from the layout to the mylar by way of the drafting aids. This way takes considerably more time, but is the cheapest if you want or need precision. Doing layouts using individual pieces of precision graph paper could get expensive after awhile.

To apply the stick-ons, slip the knife or razor blade under one edge of the stick-on. Lift carefully until it is fully off. Position the pattern over the mylar and press down gently with a finger. For larger patterns (DIPs, connector strips), use the knife to hold one side of the pattern, and a finger to hold the other. Place the pattern in position and apply light pressure. Applying only light pressure to secure patterns in place allows you to easily remove and reposition them if needed. Die cut pads can also be applied in the same manner.

Tape is applied by placing the end of the roll over the center of a pad and applying pressure to hold it in place. Then take and run the tape down to the terminating area, applying light pressure all the way. Be careful not to stretch the tape as you go, to avoid "creeping" later on. When cutting off the ends of the tape, it is best not to "cut" the tape, as this may cause a scratch or a blemish the camera will pick up later. Instead, hold the knife, edge firmly against the width of the tape. Using the other hand, pull the tape up at an angle away from the blade. This method assures a clean cut without mangling the rest of the artwork. When cutting tape at a corner, be sure to get it all. Do not let any excess hang over, preventing a nice sharp corner. Fig. 11 illustrates some dos and don'ts for artwork pattern configurations. Fig. 12 shows the finished artwork for the clock.

To mark off the edges of the board, delineation marks are available, or you can use

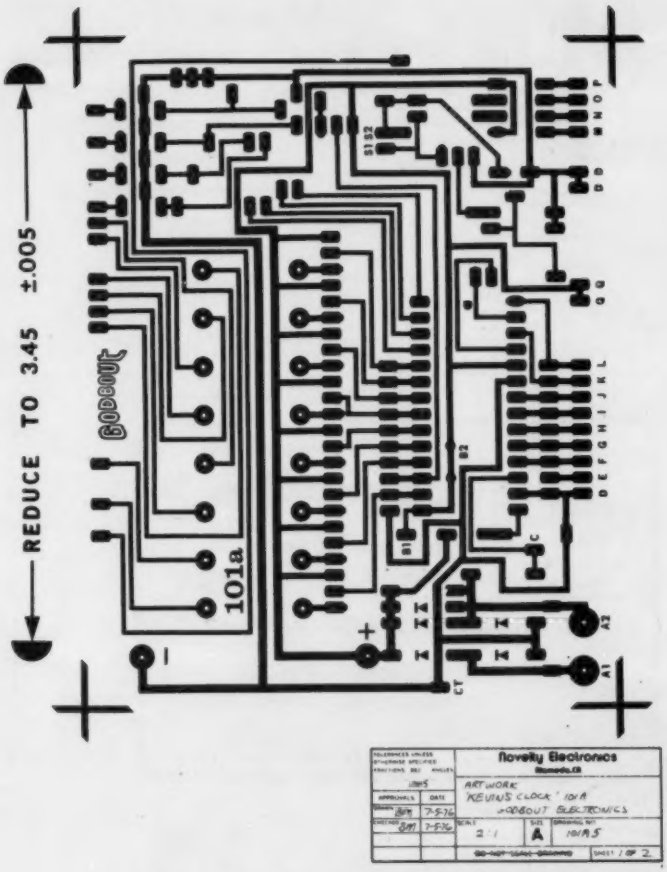


Fig. 12. Finished "main board" artwork for the clock.

two pieces of tape placed perpendicular to each other.

When you are all finished with the artwork, check it and compare it with the layout. This is the most important step of all. Bad artwork will cause bad boards, which in turn will cause a product that does not work. Now is the time to double check and make sure this does not happen.

So now you have finished artwork and want to make a board? You are going to have to have a negative made of your artwork. Do not use a 35mm or similar type camera. Results are poor and it is not worth it. Find someone with a camera designed for copying line or halftone material. (Line material is straight black and white with no shades of gray in between. Halftones are used for photographs. A magazine photo is a halftone.) The type of camera you are after is a graphic arts process camera, and may be found in companies associated with the printing industry. Some people are in business exclusively for the purpose of making negatives for the printed circuit board industry. The camera used must be dimensionally stable and have distortion-free optics. Otherwise, your finished board may be accurate in one corner but not the other.

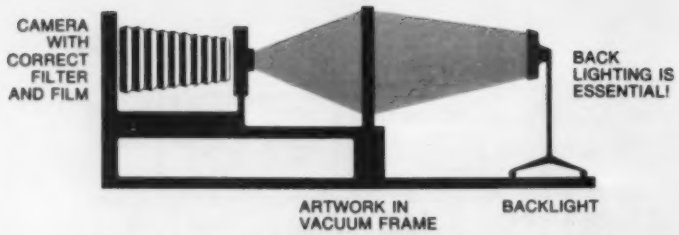
When making a negative of PC board artwork, a stable based film must be used. The best would be a glass plate, if you could find one. Glass is very stable under most conditions, but is hard to find and would be quite expensive. A good film for this purpose is 7 mil polyester base safety film.

When exposing the film, backlight the copyboard. This will increase the contrast ratio from about 50 to 1 to 1000 to 1. Needless to say, a backlit negative will have sharper edges and will produce a much finer board. See Fig. 13.

Finished artwork and negatives should be stored flat in a closed container. Temperature should be kept within 35 to 120 degrees F.

Conclusion

This month you have been provided with enough information to be able to go out and design a single-sided board. Next month, we will discuss double-sided and multi-layer boards, as well as the manufacturing process. In the meantime, I suggest you find a simple circuit and try your hand at designing a board. This will make it a little easier to follow next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ARTWORK IN VACUUM FRAME
BACKLIGHT
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Fig. 13. Backlighting the copyboard.

month's conclusion to this article.

As a final note to part one of this article, I would like to thank Bill Godbout of Godbout Electronics, Box 2355, Oakland Airport CA 94614, for allowing me to use "Kevin's Clock 101A" for illustrative purposes. More information about this clock kit may be obtained from Bill.

I would also like to thank Bishop Graphics, 20450 Plummer St., Chatsworth CA 91311, for letting me use some diagrams from their catalog. All drafting aids mentioned in these pages are available from them. If you would like to receive a catalog, you can write to them at the above address. Ask for catalog No. 106. ■

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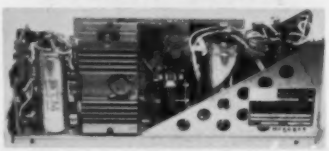

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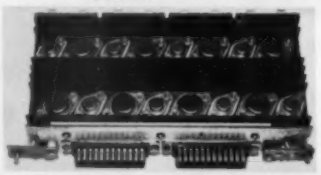

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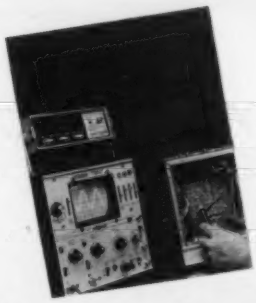

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Jon J. Gallo WA6PTM
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Announcing the PCF

- - legal aid for ham problems

In Los Angeles County, an amateur is charged with 4 criminal violations for owning a tower in excess of the local 35 foot limit and causing interference to his neighbor's television and stereo receivers. After 18 months of litigation, his legal fees exceed $18,000.

In Oklahoma, 6 licensed CBers running legal power agree to pay $100 fines each after being told by their lawyers that it will cost each of them at least $1,000 to challenge a newly enacted TVI-RFI ordinance.

In Arizona, New York, Pennsylvania, Colorado and Florida, amateurs go to court to fight denials of building permits for towers. Their average legal fees amount to $3,500.

These are not nightmares caused by too much beer and pizza during Field Day. They are merely a few of several hundred legal matters involving the Amateur Radio and Citizens Radio Services which have occurred during the last two years. The newly formed Personal Communications Foundation may be able to reduce the cost of legal services to other amateurs and CBers who encounter similar problems in the future.

Amateur radio was founded on the concept of service, both to the community and to fellow amateurs. Over the years, though noted in only a few amateur publications, numerous attorney-amateurs have literally donated hundreds of thousands of dollars of legal services to fellow hams involved in amateur radio-related legal problems. The rapid growth of amateur radio, coupled with the explosion in the Citizens Radio Service of recent years, has greatly increased the number of legal problems confronting both amateurs and CBers alike and has made necessary some form of organized assistance to the lawyers and licensees involved.

In early 1976, Wayne Green, the editor of *73*, and I exchanged a number of letters concerning a possible series of articles on amateur radio and the law. After working out the ground rules for such a series, Daniel I. Simon WA6EJW, another Los Angeles attorney, and I started preparation of the series. In order to make the articles as interesting as possible, we decided to contact a number of attorney-amateurs throughout the country to gain the benefit of their experience. Among the attorneys we spoke to was Frederick J. Lawson K6JAN, who was and still is involved in a major amateur radio case in Los Angeles County.

Shortly after our initial discussions with Fred, Robert M. Booth, Jr. W3PS, ARRL General Counsel, invited us to attend an informal meeting of attorney-amateurs to be hosted by Marshal Quiat WBØHWQ, a Colorado attorney, which was to be held during the 1976 ARRL National Convention in Denver.

In preparation for the meeting, Dan, Fred, and I prepared a written proposal suggesting the creation of a nonprofit foundation which would serve as a central clearinghouse of legal information for lawyers involved in amateur radio legal matters. This recommendation was submitted to the Lawyer's Committee at a luncheon meeting on July 17, 1976. In addition to Marshal, Bob, Fred, and myself, the meeting was also attended by B. Robert Benson VE2VW, ARRL Assistant General Counsel, Don K. Johnson W5PYA, Carl Markov K6RLP, Donald L. Royer WA6PIR, Chester B. (Barney) Scholl, Jr. K3ZFP, and Larry Perry K4EFV.

The basic concept of a clearinghouse for legal information was endorsed by the attorneys, even though we recognized that there were substantial legal, practical, and monetary difficulties with the draft recommendation. In order to give us time to work on the problems, a follow-up meeting was scheduled in Los Angeles in early September.

During the ensuing 6 weeks, substantial legal research was undertaken and on September 4th the group met at my offices, this time augmented by Richard S. Arnold W6RNP, the Honorable Maurice J. Hindin W6EUV, and Mark Weiss K6FG. Basic plans were formulated, additional research undertaken, and the decision was made to expand the organization to include the legal problems of all aspects of non-commercial, personal communications.

On November 5, 1976, Articles of Incorporation of the Personal Communications Foundation, a nonprofit corporation, were filed with the California Secretary of State. By the time you read this article, applications for tax exempt, tax deductible status will have been filed with the Internal Revenue Service and the California Franchise Tax Board.

The Foundation's principal goal is to serve as a central clearinghouse of legal information concerning all aspects of nonprofit, personal communications by radio, including amateur radio, non-commercial use of citizens radio, and shortwave listening. To avoid any misunderstanding at the outset, the Foundation is not a law firm and cannot, itself,

represent amateurs or CBers who encounter nonprofit communication related legal problems, although compiling a comprehensive list of experienced attorneys in this area is being considered.

Years ago, relatively few amateurs encountered legal problems directly related to the operation of their stations. When problems did arise, attorney-amateurs throughout the country were able to assist them with little difficulty. Today, however, literally hundreds of amateurs and CBers are encountering legal problems yearly and frequently have to turn to attorneys with little or no familiarity with either FCC rules and regulations, prior cases involving personal communications, or the technical aspects of radio. As a result, a substantial portion of the legal fees they are incurring relate to time which the attorney must devote to familiarizing himself with the law in this area and preparing the necessary legal documents. In a few unfortunate situations, the attorney has been unable to locate applicable cases and local courts, without the benefit of such cases, have rendered decisions highly unfavorable to amateur radio.

A number of cases today involve the Citizens Radio Service and some persons have questioned why amateurs should be concerned. The reason relates to how our legal system operates. Our courts follow precedents: i.e., the decisions of other courts in identical or closely related areas. If a court determines that a local municipality can fine CBers for causing TVI or can prohibit CB antennas because they are considered unsightly, other courts are likely to extend such rulings to amateur radio. Moreover, there are more than 15,000,000 licensed users of the Citizens Radio Service. When compared with 250,000 licensed amateurs, it is obvious that CBers outnumber amateurs by close to 40 to 1 and are statiscally more likely to encounter legal problems, particularly those related to zoning and RFI-TVI. It is important to the future of amateur radio that CB-related legal problems receive the same coordination and attention as those confronting amateurs.

Seated, left to right: Hon. Maurice J. Hindin W6EUV, Jon J. Gallo WA6PTM, Carl Markov K6RLP. Standing, left to right: Donald R. Royer WA6PIR, Richard S. Arnold W6RNP, Robert M. Booth, Jr. W3PS, Mark Weiss K6FG. Photo by Robert R. Jensen W6VGQ.

The Personal Communications Foundation hopes to assist all licensed amateurs and CBers who encounter legal problems by developing a comprehensive library of court decisions, legal briefs and related documents, as well as articles and studies relevant to each of these issues. To accomplish these goals, the Foundation is in the process of establishing a number of liaison and working committees. The Governmental Liaison Committee will establish lines of communication with the Federal Communications Commission, Department of Justice, and other appropriate governmental agencies. The Industry Liaison Committee will similarly establish liaison with the Electronic Industry Association (EIA) and other industry groups. Similarly, the Amateur Radio, Citizens Radio and Shortwave Listeners Committees will establish communications with appropriate users, groups, and publications, such as *73 Magazine*.

The Foundation has tentatively divided its areas of primary interest into the following sub-groups:

1. Land use regulation, including all aspects of zoning, variances and conditional use permits, building code requirements, and private deed restriction;
2. Radio frequency interference and television interference (RFI-TVI);
3. The law of nuisance as it applies to personal communications;
4. The role of the Federal Government, the Federal Communications Commission, and the States in the regulation of personal communications including the subject of Federal preemption;
5. Illegal operating practices and procedures; and
6. Miscellaneous areas.

To accomplish these goals, the Foundation plans to establish Amateur Radio, CB and Shortwave Listener liaison committees as well as working committees in each state and Canadian province. It will be the function of the working committees, in conjunction with the liaison committees, to contact both users and attorneys in their area and to secure for the Foundation copies of all relevant court decisions, legal documents, articles, and studies related to personal communications law, as well as publicizing the existence of the Foundation to both users and the legal community. Documents submitted to the Foundation will be reviewed by the Executive Director, Trustees, and other volunteer legal advisers, and will be indexed by both subject matter and state.

Upon completion of the Foundation's legal files, law-

yers, users, governmental agencies, or other individuals with an interest in personal communications law will be able to secure from the Foundation complete information with respect to all relevant decisions and legal documents in any area affecting personal communications. Such a library will greatly decrease the cost of legal services for individual users as well as assisting in the development of a uniform nationwide body of law.

The Foundation is headed by a 24 person Board of Trustees, all of whom are lawyers or judges, five Officers and an Executive Director.

Chairman of the Board of Trustees is Jon J. Gallo WA6PTM, and Vice Chairman is Richard S. Arnold W6RNP, both of Los Angeles, California. Other Trustees include Professor Jerome J. Curtis, Jr. WA6JKQ, Sacramento, California; Joel R. Kirschbaum WB7ESZ, Phoenix, Arizona; Charles Perelman WA6OGW, Beverly Hills, California; Daniel I. Simon WA6EJW, Los Angeles, California; Donald L. Royer WA6PIR, Fountain Valley, California; Chester B. Scholl, Jr. K3ZFP, Sharon, Pennsylvania; Mervyn L. Hecht WB6LEN, Pacific Palisades, California; Richard Bennett K8EHU, Reynoldsburg, Ohio; the Honorable Maurice J. Hindin W6EUV, Los Angeles, California; Harry L. Styron K6MFV, Walnut Creek, California; John A. Dundas II WA6ZCO, Los Angeles, California; Professor Stanley Siegel K8KGU, Los Angeles, California; John C. Hendricks WB9FCB, Chicago, Illinois; Howard F. Shepard W6US, Del Mar, California; Mark A. Weiss K6FG, Encino, California; Fredrick J. Lawson K6JAN, Sherman Oaks, California; the Honorable Williams L. Ritizi W6ONC, Beverly Hills, California; Robert M. Booth, Jr. K3PS, Washington, D.C.; B. Robert Benson, Q.C. VE2VW, Montreal, Quebec; G. M. Howard W5KM, Dallas, Texas; Monroe Y. Mann WA2MAJ, Port Chester, New York; and Robert H. Hajek K9LTN, Chicago, Illinois.

Officers of the Foundation are Jon J. Gallo WA6PTM, President; Richard S. Arnold W6RNP, Vice President; Carl Markov K6RLP, Secretary; William S. Finklestein WB6JAO, Assistant Vice President, Security Pacific National Bank, Treasurer; and Ronald Ruby WB6MEB, C.P.A., Controller-Accountant.

Day to day operation of the Foundation is carried out under the direction of Carl Markov K6RLP, Executive Director.

Although the majority of services are being donated without charge to the Foundation, the Foundation anticipates heavy expenses in terms of mailing, telephone costs, printing and reproduction of documents, and salaries for a limited number of part-time employees of the Foundation who handle the day-to-day administrative tasks. Contributions in any amount to offset our costs are welcome.

In addition, interested individuals or clubs may become members of the Foundation. Four classes of membership are available: associate membership for a yearly contribution of $10, full membership for a yearly contribution of $25, supporting membership for a yearly contribution of $100, and life sustaining membership for a single contribution of $250 or more. The Foundation anticipates publication of a quarterly newsletter summarizing relevant legal developments, and all classes of members will receive the newsletter.

Full, supporting, and life sustaining members will also have full voting rights for the selection of trustees.

The Foundation has applied for tax exempt status, and a favorable ruling is anticipated within the next 60 days or so.

Membership applications have not yet been printed due to lack of funds. However, memberships are available at this time and requests for membership, accompanied by your check payable to the Personal Communications Foundation, may be mailed to the Executive Director, Carl Markov, 915 West Lancaster Boulevard, Lancaster, California 93534. The request for membership should include your name, address, telephone number and FCC Amateur or Citizens Radio Service callsign, if any.

Although legal and tax considerations require that the Board of Trustees be composed of lawyers and judges, membership in the various liaison and working committees is not similarly restricted. Anyone having or willing to develop the necessary background and devote sufficient time is welcome to serve on the committees. Membership applications sent to the Executive Director may also request committee membership. Requests should specify the committee desired and set forth any special expertise which will assist the Executive Director in evaluating such requests. Committee membership is open to all, but persons holding any class of membership in the Foundation will receive priority in committee assignments.

Contributions, requests for membership, and requests for committee assignments should be sent directly to the Executive Director. Requests for other information, comments or suggestions may be sent either to the Executive Director or to Jon J. Gallo WA6PTM, President and Chairman of the Board, Personal Communications Foundation, 1900 Avenue of the Stars, Suite 2000, Los Angeles, California 90067.

The Personal Communications Foundation has been formed for you. It can only function with your assistance. ■

TO: Personal Communications Foundation
c/o Mr. Carl Markov, Executive Director
915 West Lancaster Boulevard
Lancaster CA 93534

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Personal Communications Foundation

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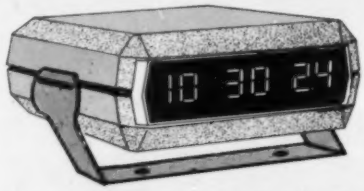

The heart of this chronometer is a high frequency crystal oscillator which provides an accuracy of ± 1 minute per month even in changing temperature or electrical "noise" conditions. Easy to assemble kit with complete step-by-step instructions. Or, for those who would rather not, a ready-built and tested unit is also available.

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12 or 24 hour time format — Displays time in hours, minutes, and seconds on 6 large, .4" red LED digits — Operates from 9-14 volts AC or DC power — Simple, non-polarized power input — Display blanks when ignition off — Internal 9 V battery assures timekeeping (without display) when external power is removed — Special circuitry surpresses voltage spikes — Recessed switches in front of case for quick and easy time setting.

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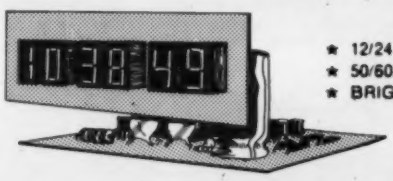
6 DIGIT LED CLOCK KIT



- ★ 12/24 HOUR
- ★ 50/60HZ
- ★ BRIGHT LEDS

This kit uses the MM5314 clock chip and is available with a choice of display sizes. Features 12 or 24 hour time format, 50 or 60 Hz input, fast and slow time setting with a hold function for precise time syncronizing. Kit includes all components, etched and drilled epoxy boards and complete step-by-step assembly instructions. (Case and transformer not included).

Kit #SI-10 with .27" Red LED's	$11.50
Kit #SI-14 with .4" Red LED's	$13.95
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CT7001 - 6-digit, Clock, calendar, Radio Timer, 12/24 Hr, 28-pin	$6.95
MK50381 - 4-digit direct drive LED, 12 Hr, 50 Hz, Radio Timer, 40-pin	$6.95

60 HZ CRYSTAL TIME BASE

This kit enables any AC powered clock to be operated on DC. Compact size — only 1" x 2". Power requirement: 5-15 VDC @ 3 mA. Kit includes all components, PC Board and easy to follow hookup instructions for interfacing with MOS clock chips.

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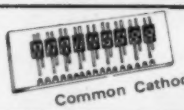

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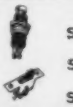

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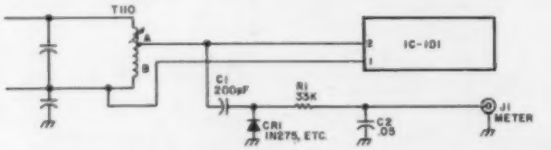
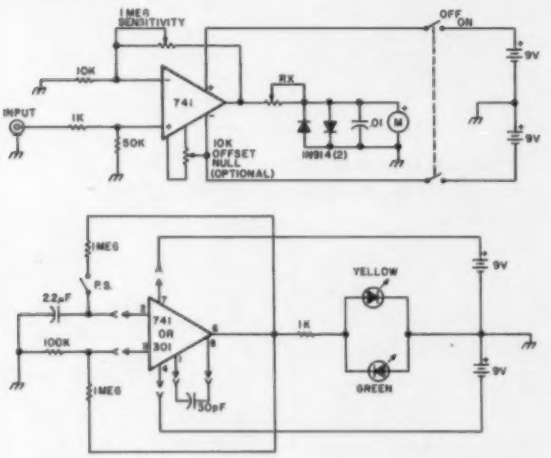
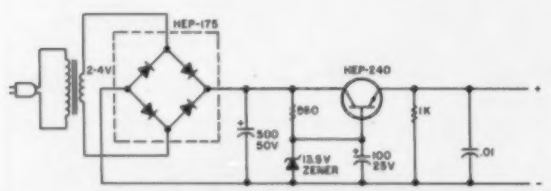


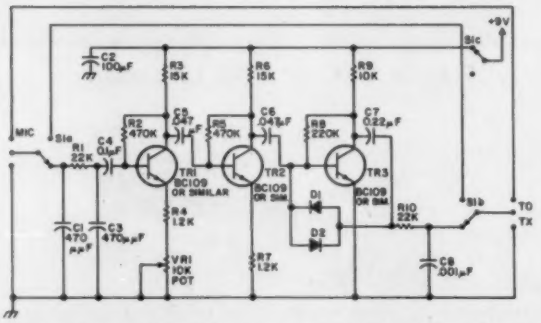
A relative signal strength meter for the GENAVE GTX-200 and GTX-10. This circuit is for a 25 uA meter movement, any style, which may be mounted external to the rig, or internally with a shoehorn (!). CAUTION . . . do not short pins 1 or 2 of IC-101 to ground or ZAP! Parts are mounted on the foil side of the board by short leads and a dab of glue. The meter lead goes to a phono socket on the rear panel under the power lead (for external meter). Be sure to use a shielded lead from the socket to the meter. If you have a meter with a less sensitive movement, say from 200 uA to 1 mA, the following amplifier circuit, wired in the meter case, will give you more than ample meter deflection with good dynamic range. $R_X + R_{meter}$ should equal 5000 Ohms. Add 10k offset null pot to 741 op amp if you want the meter to go to zero with no signal. Thanks to Larry Chrisman K9OXX (from State of the Arts, *Allen County ARTS, Ft. Wayne IN).*



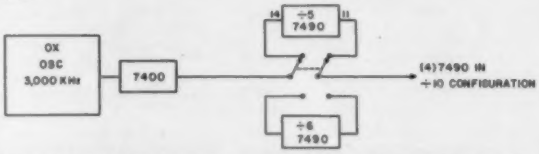
Here is a clever device to test those surplus 741 and 301 operational amps available from 73 advertisers. The two LEDs provide the necessary information when the op amp is inserted into the test circuit. If the op amp is OK, the two LEDs will flash alternately with a one second period. No flashing or illumination indicates an output fault. If one of the LEDs glows continuously, one of the inputs is faulty, and asymmetric blinking indicates a leakage problem. The circuit uses standard components throughout, and no power switch is required, as the circuit draws current only when an op amp is being tested. Thanks to J. Lawrence GW6JGA (from CQ-TV, *Journal of the British Amateur TV Club).*



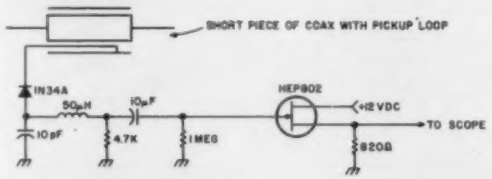
Need a simple regulated supply for your 2m rig? Try this one. The transistor may be heat sinked directly on the side of a minibox, and the transformer is any unit rated at five Amps and 24 V. Standard components are used throughout. This supply is humfree, and regulation is good — the output voltage varies only .2 V between transmit and receive. This supply is especially for smaller transceivers such as the TR-22C, used by many during relaxation TV sessions in the evening. Thanks to W8DYF.



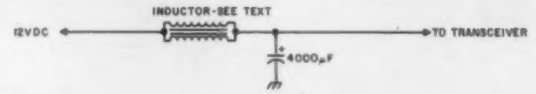
Speech amplifier and logarithmic clipper for use with SSB transmitters. The circuit reduces the speech bandwidth to about 500-3,000 Hz, thereby creating very little distortion. Power can come from the transmitter or a separate battery. Thanks to P. Burnett G4BLL (from The Short Wave Magazine, *August, 1976).*



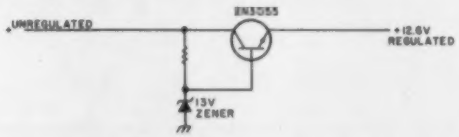
A selectable 50/60 Hz source for 12 or 24 hours with a 50250 clock chip. To have both in the same clock requires a source of selectable 50 Hz or 60 Hz frequency. A 3 meg xtal was picked because it seemed like a good choice, but a 30 kHz or 300 kHz would do as well (because when divided by 5 you get a 6 in the answer and when divided by 6 you get a 5 in the answer). Thanks to Frank W. Knottingham K7QCM.



Here's a quicky for ATV operators. This "air monitor" allows the monitoring of transmitted ATV signals with a scope. It is particularly handy in checking sync levels and shape. The pickup and detector can be mounted on a tiny PC board and installed in a minibox along the transmission line. The circuit can then be used to monitor the outgoing signal while adjustments to the modulator are made. Thanks to W3DID (from THE MILLIWATT, *a publication of the Baltimore Radio Amateur TV Society, vol. 1, no. 3).*



Bugged by alternator whine in your ham or CB transceiver? If so, try this super simple, but effective, whine filter. The LC circuit is a low pass filter which shunts the high frequency "whine" component on the dc to ground. The inductor consists of a 7 inch ferrite rod, ½ inch in diameter, wound with a single bifilar layer of No. 14 Formvar copper wire. The bifilar winding is formed by holding two wires side by side and winding the length of the rod. The two ends on each side are soldered together, resulting in an inductor capable of handling 10 Amps. The capacitor is a 4000 uF electrolytic. The negative end must be well grounded to the frame of the vehicle in order for the filter to be effective. Thanks to WB4EXW (from CVRA Repeater, *Journal of Carolinas-Virginia Repeater Association, Burlington NC).*



This simple mobile voltage regulator may save your two meter or CB transceiver if the voltage regulator fails. The 2N3055 should be heat sinked if current drawn by the rig is in excess of 2 A on transmit. This circuit will do little under normal operating conditions, but could save your rig if the vehicle's electrical system loses regulation. Thanks to WA2LPB.

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Left to right – FRG-7, Solid State Synthesized Communications Receiver • FR-101 Digital, Solid State Receiver • SP-101B, Speaker • FR-101, Digital Solid State Receiver • FL-101, 100 W Transmitter • FL-2100B, 1200 W PEP Input Linear Amplifier

Left to right – FT-620B, 6 Meter Transceiver • YP-150, Dummy Load Wattmeter • YO-100, Monitor Scope • FTV-250, 2 Meter Transverter • FTV-650, 6 Meter Transverter • FV-101B, External VFO • FT-101E 160-10 M Transceiver

Left to right – YC-601, Digital Frequency Display • YC-355D, Frequency Counter • FP-301, AC Power Supply • FT-301S Digital, All Solid State Transceiver • FV-301, External VFO • FT-221, 144-148 All Solid State All Mode Transceiver

YD-844
Dynamic Mike

Over 150 licensed radio amateurs employed at Yaesu proudly offer you the most diversified communications product line available: SSB, CW, AM, RTTY, and FM equipment - all designed for today's active amateur.

QTR-24
World Clock

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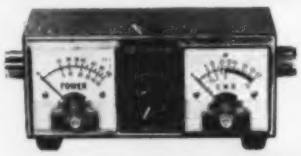

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If you're not pumping out all the power you're paying for, our little SWR-1 combination power meter and SWR bridge will tell you so. You read forward and reflected power simultaneously, up to 1000 watts RF and 1:1 to infinity VSWR at 3.5 to 150 MHz.

Got it all tuned up? Keep it that way with SWR-1. You can leave it right in your antenna circuit.

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A subsidiary of Cubic Corporation

DELUXE 742 TRI-BAND MOBILE ANTENNA

- Automatically adjusts to proper resonance for 20, 40 and 75 meters.
- Power rated at 500 Watts P.E.P.
- Includes base section, automaticoil and whip top section. 742 Antenna $79.95

EXCLUSIVE DELUXE 5-BAND MOBILE 45 ANTENNA

- All band manual switching antenna for 10, 15, 20, 40 and 75 meters.
- Power rated at 1000 Watts P.E.P.
- Includes base section with mobilecoil and six foot whip top section. 45 Antenna $114.95

Model 310-001: Standard Key, nickel plated hardware, no switch — $6.65.

Model 310-003: Standard Key, nickel plated hardware, with switch — $8.25.

Model 320-001 Standard Heavy Duty Key with nickel plated hardware, no switch — $8.20.

Model 320-003: Same as -001 except with switch — $9.35.

SSK-1: Chrome Plated — $29.95; Black Wrinkle Finish — $23.95.

Code Practice Set with Key — $18.50.

mounts - leads - accessories

STANDARD GAIN MOBILES
Two Meters

- 5/8 wavelength — 3.4 db gain over 1/4 wave mobile
- Frequency coverage—143 to 149 MHz
- Power rating—200 watts FM

MODEL SBLT-144
47" antenna complete with easy to install, no holes to drill, trunk lip mount, impact spring and 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $33.75

MODEL SBL-144
47" antenna mounts on any flat surface, roof, deck or fender in ⅜" hole. Includes impact spring, 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $31.65

HUSTLER "BUCK-BUSTER"

MODEL BF-2
51" two meter, 5/8 wavelength, 3.4 db gain over 1/4 wave mobile. Designed with ¾"-24 base to fit your mount or a wide selection of Hustler mobile mounts. (Mount or cable not included.
Price: $9.00

DELUXE MOBILE MOUNTS
For medium length, light weight antennas with ¾"—24 base.

MODEL TLM
Trunk lip mount for no holes installation on side or edge of trunk lid. Includes 17' RG-58/U connector attached.
Price: $14.85

MODEL HLM
Deluxe trunk lip mount with 180 degree swivel ball for positioning antenna to vertical. Easy — no holes — installation. Includes 17' RG-58-U cable and connectors attached. **Price: $17.20**

MODEL GCM-1
Rain gutter mount fits all shapes, angles even lipless trim line gutters. Includes 180° swivel ball. **Price: $9.00**

MODEL MM-1
Cowl mount installs in 1" hole. Includes 180° swivel ball and 50-239 connectors.
Price: $7.50

MODEL TBM-1
Trunk groove mount installs in hidden area of groove under trunk lid. Mounting hardware included.
Price: $8.00

SUPER GAIN MOBILES
Two Meters

- 5.2 db gain over 1/4 wave mobile antenna
- Frequency coverage—143-149 MHz
- SWR at resonance—1.1:1 typical
- Power rating—300 watts FM

TWO AND SIX METERS—TRUNK LIP MOUNT
MODEL HFT
Four section telescopic antenna permits separate adjustment for simultaneous resonance on two and six meters. Operational height: 40". Complete with trunk lip mount, 17' MIL SPEC RG-58-U and factory attached PL-259.
Price: $22.95

VHF/UHF ANTENNA—ROOF MOUNT
MODEL UHT-1
Field trimmable radiator for 1/4 wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Mounts on any flat surface, roof, deck, fender in ⅜" hole. Includes 15' RG-58-U.
Price: $9.95

RESONATOR SPRING—STAINLESS STEEL MODEL RSS-2
Installs between Hustler mast and resonator. Absorbs shock when antenna strikes overhanging obstructions. Supplied ready for easy installation.
Price: $ 5.40

MODEL CGT-144
Get big signal performance, superior receiving capability with this 45" colinear antenna. Easy installation on side or edge of trunk lip without drilling — Complete with 17' MIL SPEC RG-58-U and PL-259.
Price: $41.30

MODEL CG-144
Same characteristics as CGT-144 supplied with ¾"-24 base to fit all mobile ball mounts — Length is 83." Mount and cable not included.
Price: $25.50

VHF/UHF ANTENNA—TRUNK LIP MOUNT
MODEL THF
Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259.
Price: $10.55

STAINLESS STEEL BALL MOUNT FOR DECK, FENDER OR ANY FLAT SURFACE
MODEL BSM-2
Heavy 2" reinforced stainless steel 360° adjustable ball mount easily supports any whip/coil mobile antenna. Includes nylon base, steel back-up plate and mounting hardware.
Price: $10.20

QUICK DISCONNECT—100% STAINLESS STEEL
MODEL QD-1
Remove antenna from mount with easy press and twist release. Open-position spring and all parts 100% stainless steel. ¾"-24 threads—female one end, male the other.
Price: $16.95

FEED LINE MODEL L-34-240
Get known performance, maximum efficiency for minimum noise pick-up in this BNC SPEC 50 length of RG-58/U cable. Supplied with connectors all ready for use with ball or bumper mount and transceiver.
Price: $8.85

MODEL GG-144A — Deluxe, Two-Meter Colinear for Repeater or any fixed station operation. 6 db. gain over a ½ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator: ⅝ wave lower section, ½ wave phasing, ⅝ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts FM. Wind survival: 100 MPH. Installs on vertical pipe up to 1¼" O.D. 50-239 coax connector
Price: $67.00

MODEL G-32
Ball mount complete with mounting hardware.
Price: $8.20

HUSTLER RESONATORS

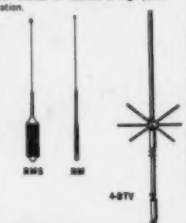
All resonators are precision wound with optimized design for each band. Assembly includes 17-7 PH stainless steel adjustable tip rod for lowest SWR and band edge marker. Choose for medium or high power operation.

STANDARD HUSTLER RESONATORS—Power Rating: 400 watts SSB

Model	Band	Price
Res-10	10 meters	$10.75
Res-15	15 meters	$11.75
Res-20	20 meters	$12.75
Res-40	40 meters	$15.00
Res-75	75 meters	$16.95
Res-80	80 meters	$16.95

SUPER HUSTLER RESONATORS—Power Rating: Legal Limit SSB
Supers have widest band-width

Model	Band	Price
Res-10-S	10 meters	$13.95
Res-15-S	15 meters	$14.95
Res-20-S	20 meters	$15.75
Res-40-S	40 meters	$22.50
Res-75-S	75 meters	$24.95
Res-80-S	80 meters	$28.95



Covers 10 · 15 · 20 · 40 Meters
Only Hustler Gives One Setting for Whole Band Coverage

MODEL 4-STV

- Lowest SWR—PLUS.
- Bandwidth at its broadest! SWR 1.5 to 1 or better at band edges.
- Hustler exclusive trap covers "Spritz" extruded to otherwise unobtainable close tolerances assuring accurate and permanent band resonance.
- Solid one inch fiberglass trap forms for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with low loss — high strength insulators. Mounting hardware included.
- All sections ⅝" heavy wall, high strength aluminum.
- Stainless steel clamps permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be easiest assembly of any multi-band vertical.
- Antenna has ¾"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for 75 meter operation when desired.
- Top loading on 75 meters for broader bandwidth and higher radiation efficiency!
- Feed with any length 50 ohm coax.
- Power capability—full legal limit on SSB or CW.
- Mounting: Ground mount with or without radials, or roof mount with radials.

Length: 21' 9"
MODEL 4-STV
Weight: 15 lbs.
Price: $99.95

For 8 · 10 · 15 · 20 · 40 · 75 · 80 Meters

Fold over mast for quick and easy interchange of resonators or entering a garage. When operating, mast is held vertical with shakeproof sleeve clutch. 58" mast also serves as 1/4 wavelength 6 meter antenna. Stainless steel base has ¾"-24 threads to fit mobile ball mount or bumper mount.

HUSTLER MASTS

The Majority Choice of Amateurs Throughout the World!

MODEL MO-2
For bumper mounting—Fold is at roof line 27" above base. **Price: $22.00**

MODEL MO-1
For deck or fender mounting—Fold is at roof line 15" above base. **Price: $22.00**

MO-1
MO-2

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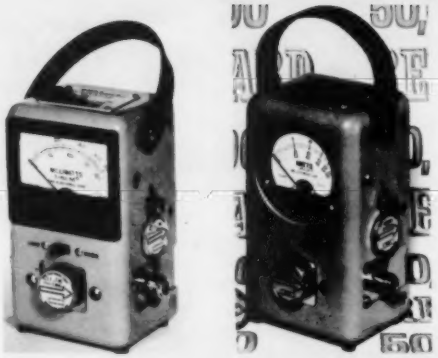
We have a complete stock of all Bird wattmeters and slugs on hand . . . immediate delivery. Order a new BIRD Ham-mate wattmeter for only $79, but please specify if you want the 200/1000 watt model or the 200/2000 watt model.



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We will exchange Bird wattmeter slugs (in good shape) bought from Hamtronics for any other slug that you may need in the future – no charge! Your wattmeter can never be outdated.

Oh no you don't! Get your own BIRD!

Come to HAMTRONICS and see the largest stock of new and used ham gear on the East Coast.

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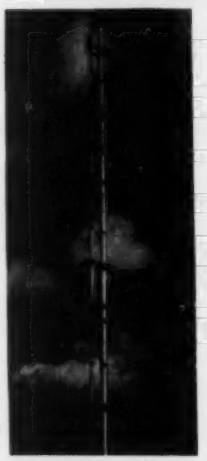
We ship anywhere in USA via UPS – NO CHARGE TO YOU

FM 2 METER ANTENNAS

- Complete stock of FM Antennas for base or mobile
- Large drive-in on the premises for immediate installation or service
- Complete line of Motorola H.E.P. transistors at all times



by Cush Craft CORPORATION

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ARGONAUT #509

AMPLIFIER #405

ARGONAUT, MODEL 509

Covers all Amateur bands 10-80 meters. 9 MHz crystal filter. 2.5 kHz bandwidth. 1.7 shape factor @ 6/50 dB points. Power required 12-15 VDC @ 150 mA receive, 800 mA transmit at rated output. Construction: aluminum chassis, top and front panel, molded plastic end panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 13" x 7". Weight 6 lbs.

LINEAR AMPLIFIER, MODEL 405

Covers all Amateur bands 10-80 meters. 50 watts output power, continuous sine wave. RF wattmeter. SWR meter. Power required 12-15 VDC @ 8 A, max. Construction: aluminum chassis, top and front panel, molded plastic side panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 7" x 8". Weight 2½ lbs.

Argonaut, Model 509 ..... $329.00
Linear Amplifier, Model 405 ..... 159.00
Power Supply, Model 251
(Will power both units) 79.00
Power Supply, Model 210
(Will power Argonaut only) 27.50

TEN-TEC

The new ultra-modern fully solid-state TRITON makes operating easier and a lot more fun, without the limitations of vacuum tubes.

For one thing, you can change bands with the flick of a switch and no danger of off-resonance damage. And no deterioration of performance with age.

But that's not all. A superlative 8-pole i-f filter and less than 2% audio distortion, transmitting and receiving, makes it the smoothest and cleanest signal on the air.

The TRITON IV specifications are impeccable. For selectivity, stability and receiver sensitivity. And it has features such as *full* CW break-in, pre-selectable ALC, off-set tuning, separate AC power supply, 12 VDC operation, perfectly shaped CW wave form, built-in SWR bridge and on and on.

ACCESSORIES:

Model 240 One-Sixty Converter....$ 97.00
Model 244 Digital Readout 197.00
Model 245 CW Filter ..... $ 25.00
Model 249 Noise Blanker 29.00
Model 252G Power Supply 99.00
Model 262G Power Supply/VOX.. 129.00

TRITON IV $699.00

KR20-A ELECTRONIC KEYER

A fine instrument for all-around high performance electronic keying. Paddle actuation force is factory adjusted for rythmic smooth keying. Contact adjustments on front. Weighting factor factory set for optimum smoothness and articulation. Over-ride "straight key" conveniently located for emphasis, QRS sending or tune-up. Reed relay output. Side-tone generator with adjustable level. Self-completing characters. Plug-in circuit board. For 117 VAC, 50-60 Hz or 6-14 VDC. Finished in cream and walnut vinyl. Price $67.50

KR5-A ELECTRONIC KEYER

Similar to KR20-A but without side-tone oscillator or AC power supply. Ideal for portable, mobile or fixed station. A great value that will give years of troublefree service. Housed in an attractive case with cream front, walnut vinyl top. For 6-14 VDC operation. Price $38.50

KR1-A DELUXE DUAL PADDLE

Paddle assembly is that used in the KR50, housed in an attractive formed aluminum case. Price $25.00

KR2-A SINGLE LEVER PADDLE

For keying conventional "TO" or discrete character keyers, as used in the KR20-A. Price $15.00

KR50 ELECTRONIC KEYER

A completely automatic electronic keyer fully adjustable to your operating style and preference, speed, touch and weithting, the ratio of the length of dits and dahs to the space between them. Self-controlled keyer to transmit your thoughts clearly, articulately and almost effortless. The jambie (squeeze) feature allows the insertion of dits and dahs with perfect timing.

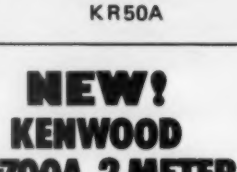
An automatic weighting system provides increased character to space ratio at slower speeds, decreasing as the speed is increased, keeping the balance between smoothness at low speeds and easy to copy higher speed. High intelligibility and rythmic transmission is maintained at all speeds, automatically.

Memories provided for both dits and dahs but either may be defeated by switches on the rear panel. Thus, the KR50 may be operated as a full iambic (squeeze) keyer, with a single memory or as a conventional type keyer. All characters are self-completing. Price $110.00

SPECIFICATIONS

Speed Range: 6-50 w.p.m.
Weighting Ratio Range: 50% to 150% of classical dit length.
Memories: Dit and dah. Individual defeat switches.
Paddle Actuation Force: 5-50 gms.
Power Source: 117VAC, 50-60 Hz, 6-14 VDC.
Finish: Cream front, walnut vinyl top and side panel trim.
Output: Reed relay. Contact rating 15 VA, 400 V. max.
Paddles: Torque drive with ball bearing pivot.
Side-tone: 500 Hz tone.
Adjustable output to 1 volt.
Size HWD: 2½" x 5½" x 8¼"
Weight: 1¾ lbs.

TEN-TEC



KR50A

TRY THE NEW ICOM SSB TWINS

Take these low cost twins anywhere! Two portable watts PEP on 2 meters or 6. HELLO DX! No need for converters or low band rigs to get started in SSB-VHF. Just add your linear amp, connect to the antenna and DX. With the 202, you can talk through OSCAR VI and VII — even transceive with an "up" converter!

IC-202 2 Meter SSB
144.0, 144.2 + 2 more! True if noise blanker, switched dial lights. 200 kHz VSO tuning. RIT only $269.00.

IC-502 6 Meter SSB
True if noise blanker, switched dial lights. 800 kHz VFO. RIT only $259.00.

NEW! KENWOOD TS-700A 2 METER TRANSCEIVER

- MORE CHANNELS 4 MHz BAND COVERAGE (144 to 148 MHz) INSTEAD OF USUAL 2.
- ALL MODES: SSB (upper & lower), FM, AM & Ch
- TUNABLE FET VFO
- AC & DC. OPERATES FROM CAR, BOAT OR AS BASE STATION
- TRANSMIT/RECEIVE CAPABILITY ON 22 CHANNELS WITH 11 CRYSTALS only $699.00.

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6 METER BEAMS

3 - 5 - 6 - 10 ELEMENTS

Proven performance from rugged, full size, 6 meter beams. Element spacings and lengths have been carefully engineered to give best pattern, high forward gain, good front to back ratio and broad frequency response.

Booms are .058 wall and elements are 3/4" - 5/8" .049 wall seamless chrome finish aluminum tubing. The 3 and 5 element beams have 1 3/8" - 1 1/4" booms. The 6 and 10 element beams have 1 5/8" - 1 1/2" booms. All brackets are heavy gauge formed aluminum. Bright finish cad plated ubolts are adjustable for up to 1 5/8" mast on 3 and 5 element and 2" on 6 and 10 element beams. All models may be mounted for horizontal or vertical polarization.

New features include adjustable length elements, kilowatt Reddi Match and built-in coax fitting for direct 52 ohm feed. These beams are factory marked and supplied with instructions for quick assembly.

Description Model No.	3 element A50-3	5 element A50-5	6 element A50-6	10 element A50-10
Boom Legth	6'	10'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	26 dB
Weight	7 lbs.	11 lbs.	18 lbs.	26 lbs.

new
RINGO RANGER for FM

4.5 dB* — 6 dB**
Omnidirectional GAIN BASE STATION ANTENNAS

FOR MAXIMUM PERFORMANCE AND VALUE

Cush Craft has created another first by making the world's most popular 2 meter antenna twice as good. The new Ringo Ranger is developed from the basic AR-2 with three half waves in phase and a one eighth wave matching stub. Ringo Ranger gives an extremely low angle of radiation for better signal coverage. It is tunable over a broad frequency range and perfectly matched to 52 ohm coax.

ARX-2, 137-160 MHz, 4 lbs., 112"
ARX-220, 220-225 MHz, 3 lbs., 75"
ARX-450, 435-450 MHz, 3 lbs., 39"

* Reference ½ wave dipole.
** Reference ¼ wave whip used as gain standard by many manufacturers.

Work full quieting into more repeaters and extend the radius of your direct contacts with the new Ringo Ranger.

You can up date your present AR-2 Ringo with the simple addition of this extends. kit. The kit includes the phasing network and necessary element extensions. The only modifications required are easy to make saw slits in the top section of your antenna.

2 METER ANTENNAS FM

A-FM RINGO 2.75 dB Gain (reference ½ wave whip). Half wave length antennas with direct dc ground, 52 ohm feed takes PL-259, low angle of radiation with 1-1 SWR. Factory preassembled and ready to install. 6 meter partly preassembled, all but 450 MHz take 1¼" mast. There are more Ringos in use than all other FM antennas combined.

Model Number	AR-2	AR-25	AR-6	AR-220	AR-450
Frequency MHz	135-175	135-175	50-54	220-225	440-450
Power—Hdlg. Watts	100	300	100	100	300
Wind area sq. ft.	.21'	.21'	.27'	.25'	.10'

8-4 POLE Up to 9 dB Gain over a ½ wave dipole. Overall antenna length 147 MHz — 23' 220 MHz — 15', 435 MHz — 8', pattern 360° — 6 dB gain, 180° — 9 dB gain, 52 ohm feed takes PL 259 connector. Package includes 4 complete dipole assemblies on mounting booms, harness and all hardware. Vertical support mast not supplied.

AFM-4D 144 - 150 MHz, 1000 watts, wind area 2.58 sq. ft.
AFM-24D 220 - 225 MHz, 1000 watts, wind area 1.86 sq. ft.
AFM-44D 435 - 450 MHz, 1000 watts, wind area 1.13 sq. ft.

8-POWER PACK The big signal (32 element array) for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 26 dB, ½ power beamwidth 42°, dimensions 144" x 80" x 40", turn radius 60", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

A147-32 146 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

8-YAGI STACKING KITS VFK includes horizontal mounting boom, harness, hardware and instructions for two vertically polarized yagis gives 2 dB gain over the single antenna.

A14-VFK.	complete 4 element stacking kit
A14-SK.	4 element coax harness only
A147-VFK.	complete 11 element stacking kit
A147-SK.	11 element coax harness only
A449-SK.	6 + 11 element coax harness only

8-4-6-11 ELEMENT YAGIS The standard of comparison in VHF-UHF communications, now cut for FM and vertical polarization. The four and six element models can be tower side mounted. All are rated at 1000 watts with direct 52 ohm feed and PL-259 connectors.

Model Number	A147-11	A-147-4	A449-11	A449-6	A220-11
Boom/Longest ele.	144"/40"	44"/40"	80"/13"	35"/28"	102"/26"
Wght./Turn radius	6 lbs., 72"	3 lbs., 44"	4 lbs., 80"	3 lbs., 16"	5 lbs., 51"
Gain/F/B ratio dB	13.2/25	9/20	13.2/25	11/25	13.2/25
½ Power beam	48°	66°	48°	66°	48°
Wind area sq. ft.	1.21	.43	.29	.26	.59
Frequency MHz	145-148	144-148	440-450	440-450	220-225

F-FM TWIST 12.4 dB Gain: Ten elements horizontal polarization for low end coverage and ten elements vertical polarization for FM coverage. Forward gain 12.4 dB, F/B ratio 22 dB, boom length 136", weight 10 lbs., longest element 40", 52 ohm Reddi Match driven elements take PL-259 connectors, uses two separate Feed lines.

A147-20T 145 - 147 MHz, 1000 watts, wind area 1.42 sq. ft.

HIGH PERFORMANCE VHF YAGIS

3/4, 1-1/4, 2 METER BEAMS

The standard of comparison in amateur VHF/UHF communications Cush Craft yagis combine all out performance and reliability with optimum size for ease of assembly and mounting at your site.

Lightweight yet rugged, the antennas have 3/16" O. D. solid aluminum elements with 5/16" center sections mounted on heavy duty formed brackets. Booms are 1" and 7/8" O.D. aluminum tubing. Mast mounts of 1/8" formed aluminum have adjustable u-bolts for up to 1-1/2" O.D. masts. They can be mounted for horizontal or vertical polarization. Complete instructions include data on 2 meter FM repeater operation.

New features include a kilowatt Reddi Match for direct 52 ohm coaxial feed with a standard PL-259 fitting. All elements are spaced at .2 wavelength and tapered for improved bandwidth.

Model No.	A144 7	A144 11	A220 11	A430 11
Description	2m	2m	1¼m	¾m
Elements	7	11	11	11
Boom Length	98"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	26 dB	26 dB	26 dB
Fwd. Lobe @ ½ pwr. pt.	46	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1

ASTATIC MICROPHONES

T-UG8-D104, transistorized $48.60
T-UG9-D104, "Golden Eagle," transistorized $95.40
T-UG9-D104, "Silver Eagle," transistorized . $69.95
UG-D104, ceramic or crystal $42.60

VHF/UHF BEAMS

A50-3	$ 27.50	A144-7	19.95
A50-5	39.50	A144-11	24.95
A50-6	59.50	A430-11	19.95
A50-10	89.50		

AMATEUR FM ANTENNAS

A147-4	$ 15.95	AFM-44D	47.50
A147-11	24.95	AR-2	18.50
A147-20T	47.50	AR-6	24.50
A147-22	69.50	AR-25	21.50
A220-7	18.95	AR-220	18.50
A220-11	22.95	AR-450	18.50
A449-6	15.95	ARX-2	28.50
A449-11	21.95	ARX-2K	11.95
AFM-4D	53.50	ARX-220	28.50
AFM-24D	49.50	ARX-450	28.50

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SP-101PB	Speaker/Patch	59
YO-100	Monitor Scope	199
YD-844	Dynamic Base Mike	29
FA-9	Cooling Fan	19
MMB-1	Mobile Mount	19
RFP-102	RF Speech Processor	89
XF-30C	600 Hz CW Filter	45
XF-32A	8 Pole SSB Filter for FT-101	49
FR-101S SOLID STATE FR 101 DIG	160-2M/SW RCVR	489
SOLID STATE	160-2M/SW RCVR	629

Accessories:		
FC-6	6M Converter	30
FC-2	2M Converter	40
FM-1	FM Detector	20
	Aux/SW Crystals	5
XF-30B	AM-Wide Filter	45
XF-30C	600 Hz CW Filter	45
XF-30D	FM Filter	49
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FL-101 SOLID STATE TRANSMITTER	160-10M	545
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FT-101E TRANSCEIVER

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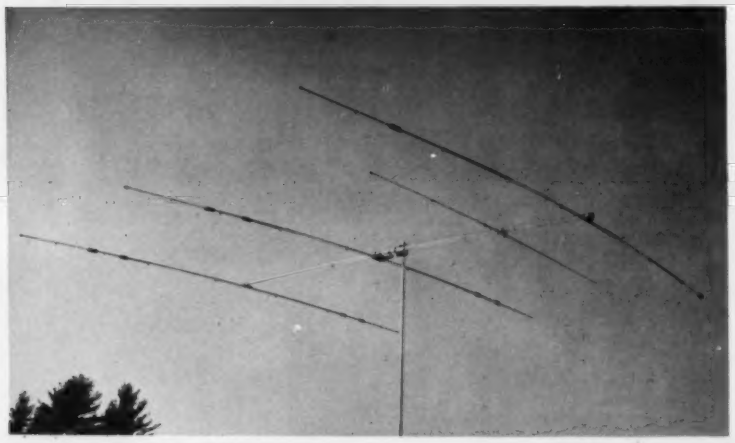
cushcraft CORPORATION

10-15-20 METER 4 ELEMENT TRI BAND BEAM



This all new 4 element tri-band amateur band incorporates the same design and manufacturing expertise which has made CushCraft the undisputed leader in VHF/UHF communications.

Our new coaxial traps are very high Q resulting in extremely low ohmic losses and longer full performance beam elements. They are rated for 2 kilowatt power handling. Feed is direct 52 ohm through the 1-1 balun supplies at no extra cost. The published gain figures are actually measured in reference to a half wave dipole on each band.

This beam gives far better performance than three element beams and it takes only slightly more space. It is easier to install and keep in the air than larger more awkward beams. Enjoy a new world of DX communication with the all new CushCraft ATB-34 Tri-band beam.

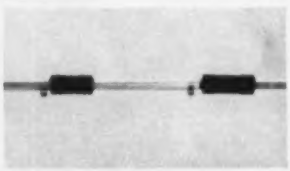
new

MACHINED ELEMENT BRACKET

new

HEAVY DUTY MAST MOUNT

new



LOW LOSS HIGH Q TRAPS

new

FERRITE BALUN

new

HEAVY WALL ALUMINUM TUBING

SPECIFICATIONS

Frequency	10-15-20 meters	Boom	2-1/2"-2" x 18'
Forward gain	7.5 dB all bands	Elements	1-1/4"-5/8" x 30'8" max.
F/b ratio	18-24 dB	Turn Radius	17'10"
VSWR	1.5-1 or less	Wind Surface area	5.4 sq. ft.
Feed	52 ohm coaxial	Assembled weight	42 lbs

MODEL ATB-34 10-15-20 METERS

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W. J. Prudhomme WB5DEP
1405 Richland Ave.
Metairie LA 70001

Build Your Own Car Regulator

- - solid state

Many car owners, at one time or another, experience electrical system problems usually resulting from a dead battery. In many instances, the battery is blamed for the malfunction when, in actuality, the electromechanical type voltage regulator is the real cause of the problem. This is usually the case, even though the voltage regulator may appear to be functioning properly.

To understand why this happens, consider the fact that a properly charged and maintained lead-acid storage battery should last the life of your automobile. When an early failure occurs, it's usually due to the voltage regulator consistently undercharging or overcharging the battery in the system. In fact, more battery failures result from improper voltage regulation in automotive electrical systems than for any other reason.

Excessive undercharging will cause the battery plates to become covered with lead sulfate, commonly referred to as "sulfating." On the other hand, overcharging a storage battery raises the temperature of the electrolyte, resulting in extreme oxidation of the plates, which eventually crack or buckle. The end result of both of these improper charging conditions is the same . . . *a dead battery.*

Electronic Voltage Regulation

To overcome the above problems, it's necessary to regulate the charging voltage at the proper level. It's up to the voltage regulator to maintain the proper system voltage and, for many years, this task has been accomplished with an electromechanical device. The main disadvantages of these devices are voltage variations due to temperature changes, unadjustable voltage settings, and mechanical type failures.

Many auto manufacturers have recognized these problem areas and as a result are switching over to solid state designs. In fact, if you own a late model car, it may already have an electronic voltage regulator. However, there are still many cars in existence today with the old style electromechanical regulator. If yours happens to be one, you can easily update it with a precision, electronic voltage regulator.

For less than $10 in electronic components, you can build your own solid state voltage regulator that should outperform any electromechanical regulator on the market today.

How It Works

As indicated in the schematic diagram (Fig. 1), this solid state automotive regulator uses a minimum of components to achieve high performance without sacrificing reliability. The heart of the

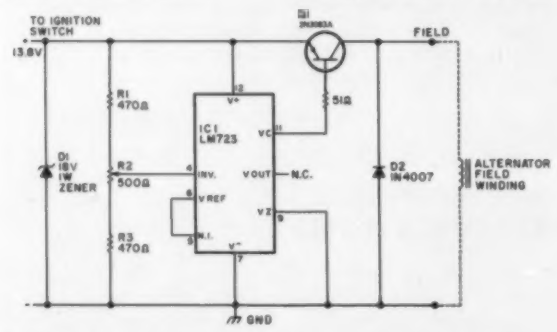

Fig. 1. Schematic. D1 — 18 volt zener diode, 1 Watt; D2 — 1N4007, 100 piv, 1 Amp rectifier; IC1 — LM723 voltage regulator (14 pin, DIP); Q1 — 2N2063A (SK3009) 10 Amp PNP transistor; R1, R3 — 470 Ohm, ½ Watt, 10% resistor; R2 — 500 Ohm, 10 turn trimpot; R4 — 51 Ohm, ½ Watt, 10% resistor; Miscellaneous — TO-3 transistor socket, 14 pin DIP socket, barrier terminal strip, TO-3 mica washer kit, PC board, minibox, optional relay (see text).

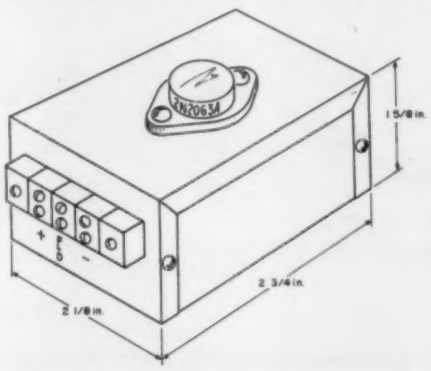

Fig. 2. Construction details.

unit is the LM723 precision voltage regulator IC, which is internally temperature compensated. This integrated circuit is connected as a switching type regulator to control current flow to the field of the alternator. Resistor R2 is adjusted to maintain a system voltage of 13.8 volts, the fully charged voltage of most standard car batteries.

If the alternator tries to produce a voltage above the set level, the LM723 turns off the pass transistor, Q1, thereby cutting off field excitation in the alternator. When this happens, the output voltage from the alternator begins to drop. As soon as the output level drops below 13.8 volts, the regulator turns the field current back on to raise the output voltage. This cycle is repeated hundreds of times a second to maintain the alternator's output voltage precisely at the set level.

The external pass transistor, Q1, is required to handle the large field current of most alternators (approximately 3 Amps), since the LM723 has a maximum output current capability of 150 mA.

Construction Details

The solid state voltage regulator may be built in a small minibox (2-3/4" x 2-1/8" x 1-5/8") as shown in Fig. 2. Transistor Q1 is mounted on top of the minibox, which is used as a heat sink. Insulate the transistor from the metal case using a T0-3 transistor socket and mica washer kit. This is necessary to prevent the transistor's case (collector) from shorting to ground.

A barrier type terminal strip (3 terminal) is used to bring the BATT, GND and FIELD connections out. If a relay is required (see installation details), you may elect to construct the unit in a larger minibox to house the relay. Also, a six terminal barrier strip will then be required to make external connections to the relay.

In some installations, depending on the mounting location of the regulator, you may want to seal the enclosure for moisture protection. However, if the mounting location under the hood is carefully chosen, this should not be a problem.

The external pass transistor is not critical, and almost any 10 Amp, PNP transistor will be adequate. However, plan to use only a DIP version of the LM723 and not the T0-5 version. The reason for this is that the DIP version has an internal reference zener diode (Vz) and the T0-5 version does not. The T0-5 may be used, but you will have to add an external zener reference diode. Also, the printed circuit board layout (Fig. 3) has been designed for the DIP version.

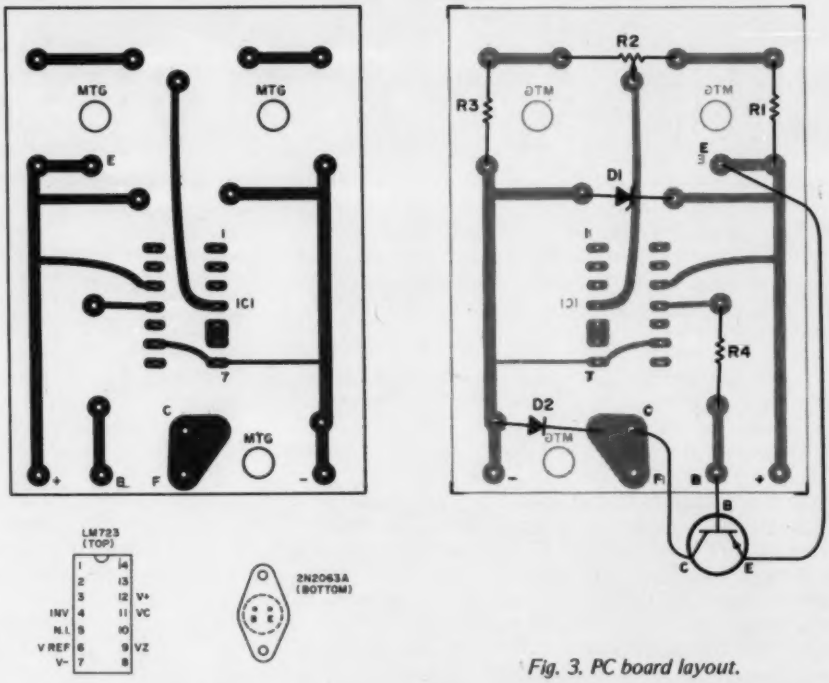

Fig. 3. PC board layout.

How to Install Your Electronic Regulator

First, try to obtain a copy of the schematic diagram for your automotive electrical system. Most local libraries will have automotive manuals containing this type of information. You should become thoroughly familiar with this diagram before proceeding with the installation.

Referring to Fig. 4, determine which system best fits your own car. Four basic types of alternator systems are illustrated: Ford/Autolite, Delcotron/GM, Motorola/AMC, and the Chrysler/Plymouth system with an ammeter. With the exception of Chrysler/Plymouth, most systems will require an external relay to maintain the alternator charge indicator light function. However, if

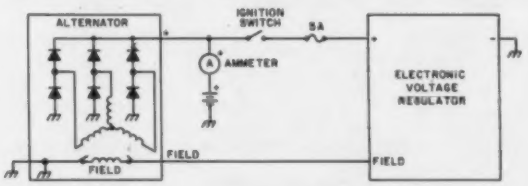

Fig. 4(a). Simplified diagram for a typical electrical system containing an ammeter in lieu of the alternator indicator light. This type of system does not require an external relay to convert to an electronic voltage regulator.

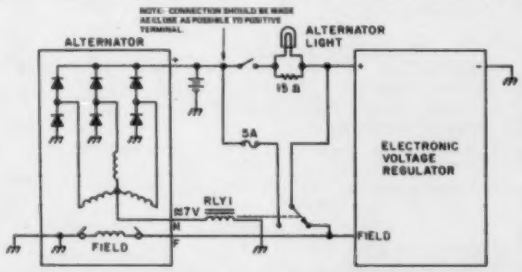

Fig. 4(b). Simplified diagram for a typical Ford electrical system with a charge indicator light. This type of system requires an external relay to maintain the function of the indicator light. RLY1 — any 6 volt relay with 3 Amp SPDT contacts.

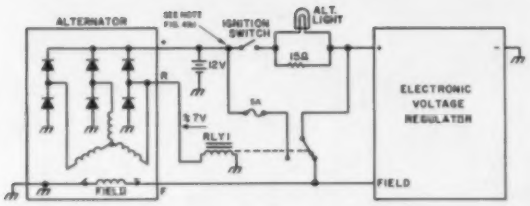

Fig. 4(c). Simplified diagram for a typical Delcotron (GM) electrical system with a charge indicator light. This system also requires an external relay if you want to maintain the function of the indicator light. RLY1 – any 6 volt relay with 3 Amp SPDT contacts.

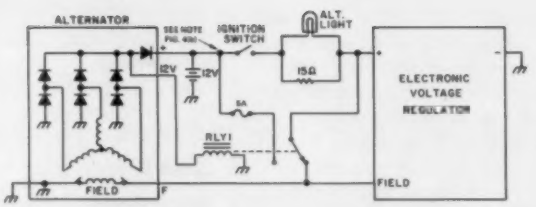

Fig. 4(d). Simplified diagram for a typical Motorola (AMC) electrical system with an internal isolation diode. An external relay will be required to maintain the function of the indicator light. RLY1 – any 12 volt relay with 3 Amp SPDT contacts.

you install an external ammeter, you can eliminate the requirement of the relay. Simply connect the regulator as shown in Fig. 4(a).

The next step is to find a suitable location under the hood to mount the electronic regulator. Preferably, this location should be near the battery and away from areas subject to moisture or excessive heat.

Disconnect the old regulator and mark each of the connecting wires for future reference, and use crimp-on connectors to connect the new regulator to the system. This will maintain the integrity of the original system connections should you ever want to convert back to the original configuration. If an external relay is required, mount it in a protected space, preferably with a dust cover or within the regulator enclosure.

After the unit is installed, recheck all wiring to insure that the system is properly connected. Before starting the engine, turn off all loads until the system voltage is properly adjusted and stable. After the engine is started, adjust the system voltage (with trimpot R2) for 13.8 volts at the positive terminal of the battery.

Check to see if the regulator is functioning properly by increasing the engine speed and adding loads to the system. The voltage should remain constant. Note: At slow idle, with loads turned on, the voltage may drop slightly, since the alternator is not producing at its rated output. At cruising speed, however, the correct voltage should be maintained if the system is operating properly.

Conclusion

This completes the installation and check-out of your electronic voltage regulator. It should provide many years of troublefree operation in addition to extending the life of your lead-acid battery.

As a final suggestion, you may want to monitor the system voltage on a continuous basis for the first few weeks after installation. If no problems are experienced during this initial trial period, it can be safely assumed that the voltage regulator is compatible with your particular electrical system. ■

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The HAPPY FLYERS

-- fun and public service

Few hams have operated any length of time without observing interference of some type. Whether accidental or intentional, it still has the same effect on a QSO (and our blood pressure). The need for devices and procedures to locate interference – and its interrelationship with finding downed aircraft – has revealed an unexpected opportunity for hams. About 5,000 volunteers are needed, plus the cooperation of many repeater groups across the nation.

Many stories have been passed from father to son and mother to daughter regarding the subtle sounds of opportunity knocking. With each story comes an imaginative narration of the consequences and/or blessings that occurred as a result of someone's reaction to the particular opportunity. Many of us have dreamed of that special opportunity that would open the door and make a dream come true.

In 1979, the International Telegraphic Union (ITU) will convene a general World Administrative Conference in Geneva, Switzerland. During the conference all the ITU rules, regulations, and frequency allocations applicable to the orderly use of the spectrum from 10 kHz to over 300 GHz will be examined in detail – and this includes the amateur radio service. In light of their voting structure, many knowledgeable hams are concerned about the outcome of this conference. The performance of some U.S. amateurs during emergencies (the Guatemala quake) and their daily operating practices leave something to be desired if we wish to make a good impression on our valuable voting friends in the ITU. On the list of attributes most likely to influence friends and votes: bad manners, poor operating practices, excessive power, and intentional interference.

It was the increasing problem of intentional and accidental interference that led the HAPPY FLYERS to the door of opportunity that now awaits opening by all U.S. amateurs everywhere (HAPPY stands for "Hams And Pilots Piloting & Yakking." – Ed.).

Our first two years were spent in organizing, recruiting, bimonthly fly-ins, our annual fund-raising "Flying Poker Party" (pick up a playing card at five airports – best hands win numerous donated prizes), public service flights, transporting hams and families in emergencies, and flying in Civil Defense drills. The number in Squadron #1 had nearly reached 200 when jamming became a severe problem on our local repeaters. Somewhere around the same time, Congress passed the ELT (Emergency Locator Transmitter) law for all U.S. aircraft. They failed, however, to make proper provision for finding downed aircraft fortunate enough to have a squawking ELT and a survivable crash.

It was the culmination of all these events and facts that caused me to accept an invitation to attend a meeting of the San Mateo County Sheriffs Air Squadron. Word was out that they had a state-issued RDF unit to issue to the proper pilot for installation in his plane. He would be the official search pilot for the county. I was greatly interested in the possibilities of adapting this special equipment to the 2 meter FM band, in order to locate jammers.

The long and short of it is that I acquired the job and the unit. Jim Williams K6HIO and I took it apart before installing it in our plane. We made numerous test flights on the amateur and aircraft frequencies. To our amazement, no modification of the state unit was necessary, provided we kept the FM rig out of saturation with a step-attenuator. We found all signals we looked for in the experimentation. The first real test was the Western States Sheriffs ELT search competition. Deputy Don Short and I located the signal in 6 minutes. I won 1st prize – and then was barred from all future electronic search competition (due to our excessively rapid find compared to the competition). Our first real plane wreck took 16 minutes from signal contact. Later, we believe we located the first jammer by airborne RDF – 22 minutes flying time straight over his house (Don Smith W6NKF, Vice Commander, Squadron #1, Dick Smith WB6WPZ, and Art Sinclair W6FKQ were at his door within the hour).

We soon developed our own inexpensive RDF printed circuit boards – one for simple AM and one with an automatic attenuator for FM/AM. We were all set to end jamming in our area. Soon many units were being built, and the jamming was shortly cut about in half (apprehension capability has a decided effect on jammers).

Then we began to see the problems in the ELT program. Poor construction standards of the first ELT units caused so many false alarms that the program went into almost immediate disrespect. Real accidents often failed to trigger the ELT, and those that did were not found easier. Few people had RDF equipment, and many who did were unable to find the signals due to their lack of understanding reflections, multipath, and the operating characteristics of the new

equipment. Experienced hams had little trouble, but seasoned pilots trained to fly low and look could not make the fool things work properly (but then that's another story we usually cover in our free RDF seminars).

As time passed, more and more problems began to surface. The HAPPY FLYERS had already begun their free RDF seminars for pilots and hams. Then a plane crashed, two miles from at least 5 ham repeaters and within VHF range of at least 5 FAA facilities that should have heard the ELT. Twelve hours elapsed before they were found. The *Oakland Tribune* reported that they were found by teenagers by accident – not by modern RDF or search personnel. Subsequent investigation turned up the fact that the FAA has officially ceased monitoring the 121.5 emergency frequency in many metropolitan areas, due to the numerous falses and tests.

We had been working on remote RDF for our repeaters to quickly locate jammers. When I read how one survivor was pinned, bleeding in the wreckage, with his brother thrown clear and unconscious, I thought about what a shame it was that we didn't have the remote RDF finished and a command at the repeater to switch to 121.5 for DF. This incident began a fabulous series of events.

Members of Squadron #1 turned their efforts from the jammers to an analysis of ELT problems. We sought input from other hams and HAPPY FLYERS through our regular column in *World-radio News*. What we came up with is the outline and nucleus of a proposal that could save the future of the ELT program, save untold lives, and give amateur radio operators, their equipment, and their ingenuity a needed boost in the eyes of the general public (and the WARC for the '79 conference).

Opportunity knocks loudly at your door. We can save lives, save a worthwhile ELT program, save billions of dollars in search and satellite funds, restore 121.5 to its useful emergency value, impress the public, and prove beyond the shadow of a doubt that we are capable of providing services for free that are not presently available by any other means. In addition, the equipment is usable on the ham bands and will give instant readout to buttonpushers and jammers. Interested? Read on.

The artist's conception drawn by our International Vice Commander Paul Hower WA6GDC shows a broad integrated ham monitoring proposal. It is a simple and logical approach originally envisioned as an areawide, interclub plan to obtain instant bearing information on jammers through the use of our HAPPY FLYERS remote RDF and an organized intergroup coordinator. Due to the design of our DF device, we can get instant readout to even a "buttonpusher."

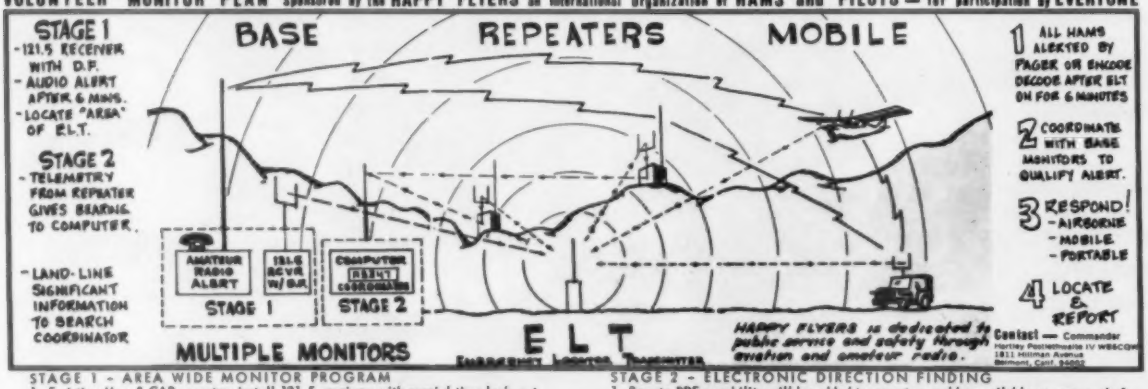
We presented a general outline of our plan to Rick Goodman, Vice President of the National Association of Search and Rescue Coordinators, at their '76 convention in Cheyenne, Wyoming. Rick, an active Albuquerque ham, informed me that his repeater club had already installed a 121.5 receiver at their repeater. He was greatly enthused about the comprehensiveness of our plan. They had no time-lockout and were rebroadcasting the ELT tones as the alert. They are now incorporating our ideas into their system. His ham group had made a terrific sound/slide show on amateur participation in search and rescue. We purchased a copy, added slides and sound covering our proposal, and are showing it in our RDF seminars and at civic groups – Rotary, Jaycees, Lions, etc. – a tremendous PR boost for amateur radio. Our group has the motto, "There is no limit to what you can do if you don't care who gets the credit." It is a great pleasure to work with people like Rick, Ray Andrews K9DUR, Bruce Gordon of CAP, Bob Kolsters, Commander, Western States Sheriffs, and our international squadrons of hams and pilots, the HAPPY FLYERS. Everyone will have to work together on a local scale, but within a national set of standards and guidelines for the program.

Due to the construction delays expected, we plan to set up the ELT Monitor Program in two basic stages. The first stage might be described as the "Alert and Elimination" stage, as shown in the drawing. Used commercial tube receivers are being made available to hams by a nationwide aircraft radio company through the HAPPY FLYERS. These receivers will be distributed to repeaters and to volunteer low band hams who live in remote wilderness areas not covered by repeaters, FAA, or military facilities.

We then hope to secure volunteers who live near the nearly 5,000 U.S. airports, to get inexpensive 121.5 receivers. Repeater and individual receivers will be equipped with a time-lockout decoder (such as the one designed for the HAPPY FLYERS by Jim Williams K6HIO), to prevent false alarms by voice communications or ELT tests. ELT tests are authorized by law, the first five minutes of every hour. The lockout decoder (parts cost under $5) will be set for about six minutes to eliminate additive individual

Nation-wide E.L.T. Program

VOLUNTEER MONITOR PLAN Sponsored by the **HAPPY FLYERS** an International Organization of **HAMS and PILOTS** — for participation by **EVERYONE**


STAGE 1
-121.5 RECEIVER WITH D.F.
- AUDIO ALERT AFTER 6 MINS.
-LOCATE "AREA" OF E.L.T.
STAGE 2
- TELEMETRY FROM REPEATER GIVES BEARING TO COMPUTER.
- LAND-LINE SIGNIFICANT INFORMATION TO SEARCH COORDINATOR
BASE
REPEATERS
MOBILE
AMATEUR RADIO ALERT
121.5 RCVR W/ D.F.
COMPUTER
E.L.T. COORDINATOR
STAGE 1
STAGE 2
MULTIPLE MONITORS
E L T
1 ALL HAMS ALERTED BY PAGER OR ENCODE DECODE AFTER ELT ON FOR 6 MINUTES
2 COORDINATE WITH BASE MONITORS TO QUALIFY ALERT.
3 RESPOND! - AIRBORNE - MOBILE - PORTABLE
4 LOCATE & REPORT
HAPPY FLYERS is dedicated to public service and safety through aviation and amateur radio.
Contact — Commander Harley Postlethwaite IV W6SCQH 1811 Hillman Avenue Belmont, Calif. 94002

STAGE 1 - AREA WIDE MONITOR PROGRAM

1. Existing Ham & CAP repeaters install 121.5 receivers with special time lock-out decoder to by-pass ELT test period and voice communication for 6 minutes. This provides high level, wide area coverage, thru thousands of existing repeaters.
2. Low-band Hams and interested citizens would install low cost monitors in homes in remote wilderness areas not covered by repeaters, FAA, or military facilities.
3. Every airport in the Country to have an individual volunteer monitor with same lock-out decoder. Receiving range cut to hear only one Airport. Purpose of these monitors to immediatly localize false Airport triggering of ELTs.
4. When 6 minute test lock-out exceeded, repeaters to generate emergency tone (2000 and/or 200 cps) to "Silent Monitor" decoders and paging receivers alerting Search and Rescue personnel and Coordinators alike.
5. Proper coordinator will assemble information from repeater and individual monitor reports. Airport falses would be immediatly identified by Airport volunteer.
6. Individual alert of all SAR personnel via wide coverage repeater tone-alert will cause pilots and ground crews to remain available while validity of emergency is verified by coordinators. Call-up can be accomplished thru repeaters or phone. Acquiring crews at odd hours will be greatly simplified.
7. SAR personnel can be reached at social functions, work, in car, or during sleep hours via extensive coverage of repeaters and use of its tone alert. Airborne search pilots would also be able to be contacted. TIME SAVED, SAVES LIVES.

STAGE 2 - ELECTRONIC DIRECTION FINDING

1. Remote RDF capability will be added to repeaters and be available on command of coordinators. Bearings from two or more repeaters will be plotted for probable area of trouble. Low cost tone telemetry has been developed for this.
2. Remote individual wilderness monitors will add low cost RDF to supply bearing information with reports via radio or telephone.
3. Airport monitors will add portable RDF capability & assist in locating offender.
4. Hams to assist in equipping more planes with low cost RDF capabilities.
5. Computer equipped Ham repeaters will inter-link for rapid calculation of more precise intersections of multiple bearings.
6. Continue free educational Seminars for Hams, pilots and other interested people.
7. Encourage pilots to report their own accidental triggerings [to cancel searches]
8. Encourage more pilots to monitor 121.5, in flight, and at shut-down.
9. Continue conducting free check rides for pilots & observers in RDF techniques.
10. Issue gold embossed DF rating cards for passing written & flight/ground checks.

ADDITIONAL PROPOSED GOALS

1. Visit with Congressional leaders, FAA, FCC officials to effect necessary changes.
2. Establish a legal proceedure to silence illegal ELT transmissions.
3. Provide Scott AFB with current lists of volunteers, capabilities, and locations.
4. Continue to seek donors of used commercial equipment, receivers, pagers, etc. to minimize overall costs to SAR volunteers in the program.

tests which would be possible with monitors who may have many airports in their receiving area.

ELT signals exceeding six minutes will trigger a tone oscillator (suggested frequencies are 2,000 and/or 200 Hz) which can be decoded by silent monitor tone decoders and belt paging receivers of participating search and rescue personnel — hams, volunteers, FAA, CAP, and Official Area Coordinators.

The elimination process will be automatically started by the tone alert. Participating airport volunteers could report to the coordinator an "all clear" or "I hear it." In less than 30 minutes, all airports would be checked. 100% "all clear" would signify a possible valid emergency. Repeater coordinators from various high location repeaters would then be polled and a second elimination process would give the general location by absence or presence of the ELT alert tone.

Little imagination is necessary to see the many benefits of stage 1 — high level monitors, airport monitors, wilderness monitors, personnel notification, general search area probabilities, 24 hour reliability by the silent monitor and lockout timer, rapid response, multigroup participation, favorable ham PR with the community, further evidence of the value of the amateur bands and the technology that has historically shown that hams can often fill design gaps.

Stage 2 will add RDF (Radio Direction Finding) capability to repeater and individual monitor stations. Computer-equipped repeaters will link for automatic processing of bearings. Hams will help train non-electronically oriented pilots and search personnel in the techniques of transmitter hunting (present airborne RDF equipment is now accurate to a couple of feet at crossover). Hams will continue designing the special electronic devices needed (like the VOX audio repeaters designed by the HAPPY FLYERS and Rick's New Mexico group).

As you remember, I mentioned earlier that this all ties in with our jammer problem. The same DF equipment will work on ham, aircraft, and marine frequencies. We will have an established interclub group, with equipment, procedures, and skills sharpened by experience. We will have assistance from other groups (members of Western States Sheriffs Air Squadrons have volunteered to assist in airborne jammer hunting with their ELT RDF units). Jammers think twice before pushing the button when the chances of being caught are high. You don't park in the same illegal parking space if you get a ticket every time.

Where do *you* fit in? Each area will need to set up its own program. This means leaders, workers, builders, listeners, donors, and equipment. You have the choice as to how much you can or will do to further this program. The HAPPY FLYERS is an international volunteer organization of hams, pilots, and flyers (those interested in flying but not necessarily hams or pilots). We are a no dues, no fees organization, with no paid employees.

Due to our nonprofit structure and our no staff operation, we hope to see as much accomplished at the local levels as possible. We will provide information and all other help possible. A self-addressed stamped envelope on all correspondence will be greatly appreciated — both from the time and money standpoint. As you begin to organize, we will need to know who is in charge of the operation in your area. As we receive word that used commercial equipment becomes available either through donors or at drastically reduced prices, we will need to know whom to pass the information on to. Many companies would rather not be bothered by calls from individuals, but will make master arrangements with groups like ours. Our thanks to those who have already called.

As you can see, we are really "into" this. I think you have the main ideas. Your suggestions are also solicited. You've got the ball — do something with it. ■

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10 and 11 Meter Predictions

- - buy your stock now

For the past several months, I have been planning to write an article on the next sunspot cycle (which, by the way, appears to have started last November, very slowly) and its effect on CB radio. But prudence has held me back. I have lived with the sun through three high sunspot periods as the Propagation Analyst for RCA Communications and have learned to have a great deal of respect for the whims of this great ball of atomic fire. However, I have today thrown caution to the wind and have decided to go through with it. Some stories that have appeared in newspapers and magazines recently are responsible for this change of mind.

The stories that I have read were telling the CBers that their band (11 meters) is likely to be in a shambles during the next sunspot high due to long distance co-channel interference on account of sunspots and that the CBers will be all fouled up. I do not agree with this pessimistic view. If the forthcoming high was going to be like the high we had in 1957-58, I would tend to agree with them somewhat, but I do not think that it is. In fact, I expect the next high period, which should run from 1979 to 1982, to be the lowest we have had since the early 1800's.

I estimate that the yearly mean of the forthcoming cycle high of 1979-82 will be about 20 to 25 spots higher than the cycle high that took place between 1802 to 1805. I have increased the number by 20 to 25 because the astronomers will probably count more spots today with better telescopes than the astronomers did in the early 1800's. The comparison is given in Table 1.

My own experience with sunspot numbers and frequency variations has indicated to me that a count of 90 to 100 is necessary to bring the 10 and 11 meter band into operation *with any degree of consistency*, although temporary bursts of sunspot activity can bring it to life for shorter periods of time. Old time hams are, of course, well acquainted with the relationship that exists between sunspot numbers and the maximum usable frequency (MUF), and no doubt many of the CBers are also, but for the benefit of those who do not know this, perhaps a few words of explanation are in order.

Ultraviolet radiations from the sun create and sustain the ionosphere, which makes it possible to communicate over great distances with high frequency radio (HF). Since sunspots radiate very strongly in UV, it stands to reason that the more sunspots the sun produces, the stronger the ionosphere will be. A strong ionosphere will reflect back to earth the higher frequencies and, if there are enough of them, the 27 and 28 MHz band of frequencies (10 and 11 meters) can be used for communication over vast distances – often six to eight thousand miles. And this they can do with very low power. When sunspots are scarce, these frequencies are usually good for short distances only.

When operational, the 10 and 11 meter bands of frequencies are at their best when the sun is shining on both the transmitter and the receiver at the same hour. They are rarely useful for long distances when a part, or all, of the ionosphere is in darkness between the transmitter and the receiver. In addition to a sunspot number effect upon the MUF, there is also a very pronounced seasonal effect. For any given sunspot number, the ionosphere will reflect a higher frequency in December than it will in June ... all the winter months are higher than the summer months.

RECORDED		PREDICTED		COMPARED WITH 1958 HIGH	
Year	count	Year	count	Year	count
1802	45	1979	65-70	1956	142
1803	43	1980	63-68	1957	190
1804	48	1981	68-73	1958	185
1805	42	1982	62-67	1959	159

Table 1.

I have the actual frequency records on commercial radio circuits for June and December, 1968, wherein the highest useful frequency was recorded every two hours of the day. June, 1968, had a mean sunspot number of 110 and the average of the highest frequency useful during the daylight hours was 22.2 MHz, while in December with a mean sunspot number also of 110, the average of the highest frequency useful during daylight hours was 25.3 MHz. In June, the highest frequency during the month was 26 MHz, and that appeared for only one day. In December, the highest frequency was also 26 MHz, but was useful for 18 days. These recordings were taken on high speed commercial circuits working at 240 wpm (four 60 wpm teletypes on multiplex) and had to provide good copy for several hours per day. Circuits with less stringent performance parameters could be used above 26 MHz; therefore, we can say that 26 MHz was not the full MUF, but it was close.

We will now pick a year with about 70 sunspots in December and analyze that for the December frequencies under these sunspot conditions. The sunspot number records show that December, 1966, had a sunspot count of 70. My frequency records show that the monthly average of the highest frequencies used was 21.5 MHz, with 24 MHz being the highest, but it appeared for only one day during the month. The next highest was 22 MHz, which appeared in the records for 16 days. This gives us an idea of what to expect during the winter months of the next sunspot high if my predictions are right.

An interesting comparison can be made for December, 1957, with a sunspot number of 239. The records show

that the monthly average of the highest daylight frequency observed was 27 MHz. The highest frequency observed for the month was 28 MHz (the ham band frequency of 28 MHz was checked every day to see if it was there). We had no way of knowing what the real MUF was, however, because of frequency limitations. Also, these observations were made on east-west transatlantic circuits.

A ham friend of mine read this manuscript up to the end of the preceding paragraph. When he had finished, he turned to me and said, "Well, what's it gonna be? You forecasters are all alike – ambiguous and evasive, nobody can pin you down." (This fellow was an insurance agent – imagine an insurance agent calling somebody else ambiguous.) He told me to put my neck on the block. So here it is, October to February, 1979/1982, daylight paths only on east-west circuits:

A. The 10 meter band (28 MHz)

This band will be spotty, coming to life with periodic bursts of sunspot activity. Far below 1958 and 1968 qualities.

B. The 11 meter band (27 MHz)

The CBers will not have any important co-channel interference problems (unless somebody decides to put his on a high gain antenna).

C. The 15 meter band (21 MHz)

This band will be the workhorse band for DX.

D. The 20 meter band (14 MHz)

This band will also be useful as a secondary workhorse band and with performance pretty close to that of the 15 meter band.

Forecast completed December, 1976. ■

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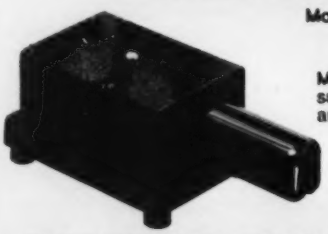

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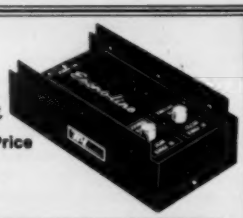

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BE MY GUEST
visiting views from around the globe

from page 11

had, along with a good idea of how his rig could be identified (off frequency, lousy quality, and cold solder joints). Sorry, Dave; just kidding.

It turns out that Dave's follow-through was of great interest to the police in Hanover. It appears that the "Bad Guy" was a suspect in a number of unsolved cases, and they had never had enough evidence to search his home. With the information that Dave and the 07/67 "Mission Impossible Team" furnished, a Heathkit two meter rig was recovered, along with a few CB rigs and a stolen gun. I understand the investigation even led to recovery of several thousands of dollars of household items and put an end to a housebreak ring in the South Shore.

So to those of you who may encounter a "breaker," play it cool . . . give him the low key approach, and then pass the information along to the proper authority. Who knows, you might catch a thief . . .

By the way, the 2,000,000 to 1 odds did pay off. It was Dave's rig and he has it back on the air (except for when he leaves his car, he is the guy seen wandering around the South Shore with a Heathkit under his arm).

Breaker, breaker six . . . 10-4, good buddy.

Bandwidth Revisited

It appears that the FCC is at it again. The controversial "bandwidth" proposal, Docket 20777, has been shelved for the present time. FCC Chief Engineer Ray Spence indicated to *73* that a large amount of amateur interest has been generated by the proposed docket. This proposal would have, among other things, excluded AM from segments of the low bands and restricted bandwidth in the 420-450 spectrum to 35 kHz, thus banishing ATV as it now exists.

Spence indicated that a large amount of the comments were critical, especially those from the ATV enthusiasts. It was indicated that the FCC will develop another proposal concerning bandwidth; however, Spence said it would be "quite a while" before action is taken.

73 has received a considerable amount of input from interested hams concerning the bandwidth docket. Much, much more data is required, as we are being given a golden opportunity by the FCC to create our own proposal concerning bandwidth and the whole general topic of amateur radio deregulation. We at *73* are prepared to act as a clearinghouse for comments, proposals, and suggestions relating to amateur deregulation. The bandwidth question is presently the hot subject. However, please do not overlook other aspects of deregulation, such as repeater rules relaxation. (Refer to this month's "Briefs" in *73*.) Let's get going! Talk up deregulation and bandwidth proposals at club meetings and over the air -- the ball is back in our hands. Organize your thoughts on paper, and send them to *73*.

A questionnaire is being prepared by the *73* staff concerning repeater coordination, deregulation, and bandwidth. This will initially be sent to those who originally commented on 20777. Repeater coordinators will also receive a form, as well as the clubs listed in our files. Any individual or club requesting a questionnaire should write *73*, marking the card or letter "Bandwidth Questionnaire."

In a few weeks (time is short), we will compile a proposal based upon your suggestions. This will appear in *73* and will aid us in our conversations with the FCC. Start planning!

John Molnar WB2ZCF
73 Magazine Staff

Amateur Antidote

"Break . . . Emergency . . . ZP5NP." That distress call broke into what had been an ordinary day for amateur George B. Riley, who was on a QSO with several other hams in the Virgin Islands from his home in Linden NJ.

Riley, an engineering supervisor at WOR-TV in New York City, became a link in a communication chain to the Food and Drug Administration's National Clearinghouse for Poison Control Centers in Bethesda MD.

ZP5NP was Paraguayan Army Sergeant Nelson Guadalope, who was attempting to connect with any American ham who could reach proper medical authorities to aid in treating a six year old girl who had swallowed a chemical herbicide known as Tributon.

A local doctor had originally treated the girl for a severe cold. Only after she had become gravely ill had the doctor discovered that she had drunk the poison. The doctor needed information about the ingredients in Tributon and was unable to get it locally. So he turned to the U.S. for aid.

While still in contact with ZP5NP via another amateur in the Virgin Islands, Riley was able to contact the FDA's Division of Poison Control where pharmacist Larry Trissel had just reported for duty. Trissel consulted his index cards where products are listed alphabetically by brand or generic name. After some initial confusion over the spelling of the product, the ingredients and proper treatment were found.

Only about ten minutes had passed between Riley's original call to the hospital and the prescription of treatment. However, transmission difficulties delayed the relay of the information to Paraguay by almost an hour. Nevertheless, the information was received in time to save the girl's life.

Riley later received a letter from the U.S. ambassador thanking him for helping in the girl's recovery. Through Riley's efforts, amateur radio received valuable publicity.

James Wilson

Reprinted from The Catholic Digest, *January, 1977. The article originally appeared in the* FDA Consumer.

Trevose Tower-Plus Eight

It was back in June of 1969 that Preston Funk had his famous tower built in his backyard at 4860 Magnolia Avenue in Trevose.

The tower is 229 feet tall. It has become a landmark in more ways than one in the nearly 7½ years since it was constructed.

It seems as though there have been as many hearings to decide what to do about the tower as there are feet in its height.

A neighbor of Funk's started a long list of complaints shortly after the tower was finished and Funk began using it for his "ham" radio operations.

The neighbor complained he was receiving radio signals from Funk's station over his home radio, television set, and telephone.

The Federal Communications Commission got into the proceedings. The FCC suggested a complaint also be filed with its office in Philadelphia. The FCC also told Funk's neighbor that a filter of the proper kind installed on the TV set would eliminate the interference.

20 Meetings

In the first year, there were more than 20 meetings held by Bensalem governing bodies in an attempt to clarify the situation. That number has doubled.

There are more than 90 stories in the files of the Bucks County *Courier Times* concerning the tower since it was completed around June 25, 1970.

On March 25, 1970, the Bensalem Township Zoning Hearing Board ordered Funk to take down his tower.

As anyone who has driven by the imposing structure lately can see, it still is there, poking its way into the sky.

In May of 1974, a Bucks County Court ruled against Funk's appeal in March, 1970, agreeing with the Bensalem zoners that the tower had to come down.

He followed his defeat in the Bucks court by appealing to the Commonwealth Court of Pennsylvania. In February of 1975, the state court, too, ruled the tower should come down.

Helping Victims

In between the two court rulings and appeals, Funk's ham radio station proved its worth.

When Hurricane Agnes brought the state's worst flood in June of 1972, hundreds of people made use of Funk's ham radio facilities to send messages to relatives in the flood-stricken areas.

Later, when earthquakes devastated Managua, Nicaragua, Funk again acted as a go-between for messages to and from the stricken area.

Meanwhile, new homes have gone

up on Magnolia Avenue. One of them is directly across the street from Funk's tower. Mr. and Mrs. Edward H. Kolb live there.

Mrs. Kolb said today, "We moved from Philadelphia about a year and a half ago. I see the tower every day. It's right across the street, But it doesn't bother me. And we haven't had any interference problems on our television or radio."

A few houses down the street, Charles W. Conley echoed Mrs. Kolb's remarks. "No, we haven't had any trouble, either. The tower doesn't bother me at all."

Hearing Rescheduled

Last night, the Bensalem Township Zoning Hearing Board scheduled another meeting to hear Funk's bid for a variance that would allow his tower to remain up, despite the adverse rulings by the courts.

This hearing was postponed from April, scheduled for May, when it was postponed again — until last night.

Two members of the board couldn't make the meeting. So, once again, a decision on Funk's tower has been put off.

On hand last night were a lawyer or two, a reporter, a couple of persons who had other business to transact with the zoning board, but no spectators.

It would appear Preston Funk and his tower have outlasted the opposition. After 7½ years, even Muhammad Ali would get weary of battling the same foe.

Reprinted from Courier Times, *Bristol PA, November 18, 1976. Thanks to* X-MITTER, *Journal of the Penn Wireless Association, Bristol PA.*

LF-Still Many Questions

Simultaneous observations by three satellites have confirmed that long waves in the earth's magnetic field, which spread the disruptive effects of magnetic storms on earth, are generated far out in space by energetic particles from the sun.

Drs. Joseph N. Barfield of the National Oceanic and Atmospheric Administration, R.L. McPherron of the University of California at Los Angeles, and W.J. Hughes of London's Imperial College, reported the results of their satellite measurements at the fall annual meeting of the American Geophysical Union in San Francisco early in December.

They found that the low frequency waves are generated by the solar wind, the constant stream of energetic particles that flows outward from the sun. When the solar wind strikes the magnetopause (the boundary where the earth's magnetic field loses its dominance and bows to the sun's), it generates waves in much the same way as wind does over water, according to Barfield. These waves travel earthward, enter a "resonant region" where they are amplified, and propagate down to the ground. In ways that are still poorly understood, they are involved in magnetic disturbances, which disrupt communication and power transmission on earth.

But they also have some pragmatic uses, in oil and mineral exploration. By monitoring the waves as they travel through different spots on earth, prospectors can learn something about the substructure, such as the location of ore bodies. Paradoxically, the waves may also aid communication. Since they penetrate the ocean, they may someday be used to communicate with submarines, which now have to surface to make contact.

Hughes, Barfield, and McPherron detected the waves from magnetometers aboard three satellites in synchronous orbit 22,200 miles (35,720 kilometers) above the earth, the first time several satellites had been used to make such measurements simultaneously. The environmental satellites SMS-1 and SMS-2, and ATS-6, a research satellite, are in a line along the earth's equator, each orbiting at a speed that keeps it poised above the same spot on earth. Hughes, Barfield, and McPherron used this satellite arrangement to determine the origin of the electromagnetic waves.

The magnetopause curves around the sunward side of the earth, with a "nose" pointing toward the sun. The three space scientists predicted that if the low frequency waves were generated at the "nose," as they believed, the first satellite to detect the descending wave front should be the one closest to the sun at the time. They found that the wave front did pass each satellite in the predicted order.

The satellite measurements also showed how the waves are amplified and propagated, according to Barfield, a researcher with NOAA's Space Environment Laboratory (one of the Commerce Department agency's Environmental Research Laboratories). Originally, it was thought that the lines of force of the earth's magnetic field would vibrate like a guitar string, setting up the waves.

Early ground-based observations also had suggested that as a wave generated at the magnetopause travels inward toward earth, its amplitude decreases until it reaches a certain altitude, a "resonance region," where it is amplified.

The three satellites are located right at this resonance region. "For the first time we could look at things right where they were happening, with multiple probes," Barfield said. Measurements from the satellites confirmed the existence of the resonance region by observing the change in amplitude of descending waves. The "guitar string" theory was not all wrong, but the waves do not originate at a magnetic field line; they are amplified there. "A wave travels earthward until it finds a magnetic field line that responds to the particular frequency of the wave," McPherron explained. This is the resonance region.

The scientists used the amplitude changes of the waves to infer some of the characteristics of the resonance region. By noting how changes in amplitude of the waves differ between the satellites, the researchers found that the resonance region is very narrow on a magnetospheric scale — about 750 miles (1,200 kilometers) thick.

The next step in the research, according to Barfield, is to look at the characteristics of the waves; what are the spatial limits of where these waves occur and how do they relate to local features of magnetic disturbances?

The scientists hope to study the wave frequencies to learn something about how matter is distributed along magnetic field lines. First, it is necessary to calibrate the waves—to learn what different wave characteristics perceived at earth reveal about what is going on farther out in space. For that, the satellites, with their direct measurements, are needed. But later, it may be possible to use the waves that reach earth to study the magnetic field thousands of miles above.

Louise A. Purrett
Boulder CO

On the Verge

The other day, listening on 75 meters, I came across a QSO that really jostled me. Two fellows were discussing the "sorry" state of ham radio. "All I do is work the same people, night after night," said one guy. His buddy replied that he "was having more fun on the way to work in the morning on the CB band." I've been listening to those two for years, and they never leave 75. Night after night the same QRM, the same dull conversation, and the same holding pattern.

It made me a little angry to hear them blaming ham radio for their fading interest. Neither of them (as near as I can tell) ever venture off 75, and until a year ago, they were running AM day and night, with the expected results. When the going got tough, they just kept on transmitting, carrier and all, trying to cover the 30 or 40 miles between them on a frequency filled with 9s and 5s. I guess it never occured to them to QSY to 10 or 15 when nighttime conditions on 75 got too rough. Or, how about VHF . . . couldn't they make it on 2 meter direct?

The real hangup these fellows seem to have is no interest in trying some of the other activities ham radio has to offer. Neither of them apparently realizes they could listen for OSCAR, and key a 2m HT to get into it. They probably never thought of running QRP, or trying 160m, either. And they both will probably continue until their dying gasps, squeaking out 50% QSOs on 75.

There has to be a way to save these guys. Otherwise they will be lost forever, just like those 64 thousand some odd satellite frequencies lost in the last WARC. Maybe we're too involved in pulling new amateurs into the fold, and are passing by hundreds of old-timers who've been buried in new technology.

When I think of all the things those two are missing out on, I feel kind of sad. It's the same feeling I have when I think of 19 CBers in the Baltimore-Washington area facing federal charges, because they tried the easy way into ham radio. The HFers, as they call themselves, may have the upper hand in numbers (when you consider the meager forces of the FCC). But sooner or later they will be caught, and I wonder how many Novice or other class amateurs will be among them.

The SSB outlaws and 75m hangers-on both have the same problem. Their collective lack of incentive must be a reflection of their lives. They stand on the verge of all ham radio has to offer, but take the easy way out . . . whether it be complacency or lawlessness. Think about it.

Warren Elly WA1GUD
Associate Editor

LETTERS

from page 111

ability of 30-50 MHz commercial equipment, I'd like to see more activity on this channel.

I've been monitoring 29.6 for the last 3 years, and I can tell you that 10 is open much more often than most hams believe. How about it OMs? More 29.6!

Michael R. Downing WB6OIM
Canoga Park CA 91306

A LITTLE PUSHING

I would like to take this opportunity to commend the author of "Hutchinson's Remedy," an article which appeared in the Holiday issue of this magazine. VE3CWY did an excellent job describing his cure to VFO chirp. The article was concise, explanatory, and interesting to read.

It seems this article could be a hit with those who don't like to use ICs and other solid state components, yet want to cure their home brewed VFO of chirp.

This is the type of article I believe will be popular among some *73* readers, who want practical applications for these new ICs, etc., to make them use them — I know I am one who needs a little pushing in this direction.

John Pilson WA1UZK
Saunderstown RI

INSPIRATION

I want to thank you for sending me your recent advertisement. It has inspired me anew.

For years now I have neglected my ham radio hobby, yet I continued to pursue studies of electronics which opened the door for a very rewarding career. I owe it all to a couple of "old hams" and publications such as yours for sparking a desire within me to want to know!

Now, more than ever before, I feel the need for promoting, practicing, and enjoying one of the most stimulating hobbies ever conceived. Perhaps I can spark that "want to know" in someone through ham radio and its many facets that have touched, changed, and made more rich our lives.

Keep up the good work and much luck to you in your efforts.

Kenneth R. (Randy) Lewis WB4NIH
Summerville SC

HELPING OUT

I am presently studying to get my Novice class license and your magazine and its articles are really helping me out. I've tried to read and understand *QST*, but find it very hard for someone who wants to become a ham. I know that your magazine can do a lot for someone who wants to become a ham.

Louis Zimmerman
Mexico City

THE ABOVE MENTIONED

Just thought I would drop a few lines and let you know how much I enjoy the construction articles in *73*. Just finished building K2OAW's 11C90 prescaler as well as the solid state subaudible encoder in your Dec. '76 issue.

I do wish that all your authors who go to the trouble to build PC boards for their construction articles would provide layouts for duplication such as the above mentioned did.

Although I do believe that microprocessors and such are the way of the future, I think the bulk of your I/O articles would be better suited for your new publication *Kilobaud* and not taking up space in an amateur publication.

Allen Jones K9DZE
Michigan City IN

QUICK, CLEAN HEAT

How come you don't have a regular Hints & Kinks column? Would seem to complement your "Circuits" section which I like so well.

Anyway, my idea that I'd like to share is keeping one of the throwaway butane cigarette lighters like the Cricket with my shrink tubing. It's a fine source of quick clean heat.

John Diebold W7SCU
Seattle WA

ANOTHER CHARTER

At it again, eh? Some people chase butterflies. Some collect stamps, others dabble in the stock market. And still others seek Billy Holliday Records.

But you! None of the above are good enough for you. Your hobby is starting magazines! No complaint, mind you. Just an observation.

I can't complain. As a *73* lifer and a (forgive me) charter *Byte*r, I feel I'm ahead of the game. Add me to the list of charter subscribers to *Kilobaud*.

Ralph O. Irish Jr.
Utica NY

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The six words per minute practice cassette will make sure that you will almost fall asleep during the FCC test. This one hour cassette (which will play in any cassette recorder) has only coded groups of letters so it is impossible to memorize, unlike the beginning cassette which has words and phrases which will have you laughing and make everyone think you are crazy . . . unless they can read the code too.

You get your theory explained in detail by Wayne Green (he did the code tapes too) on a four cassette set . . . three for theory and one questions and answers. You'll learn your fundamentals of electricity and radio at the hands of a true expert, which means you'll have no trouble understanding at all. What a difference this makes when you want to go on to a higher class of license. It really pays to thoroughly understand basic theory, for then no manner of tricky FCC questions can throw you off – and they do get tricky at times, curse their dark hearts.

You'll also get a Novice License Study Guide which covers the theory and the rules and regulations. There is a reprint of the latest FCC rules . . . something that is difficult to find anywhere else. The theory in the book will reinforce the cassettes, making everything even easier to remember.

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			$30.80

Our business is publishing a magazine and these things are just a sideline with us, because we feel that the more amateurs we can get licensed the more 73 readers there will be. In order to help make things easier for newcomers to get licensed we're offering the complete Golden Road Kit for just $24.95 . . . that's a $5.85 saving! This offer is good for a limited time, so if you know of anyone who is interested in getting a ham ticket, send for this complete Novice system. There is no easier way to get a Novice license than with the Golden Road Kit by 73 Magazine.

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Social Events

MARSHALL MI
MAR 5

An unconventional Swap Fest will be held by the Southern Michigan Amateur Radio Society in conjunction with the Marshall High School Radio Club on Saturday, March 5, 1977 at the Marshall High School, Marshall, Michigan (near I-94 at I-69). Tech sessions, computer sessions, DX, VHF, YL meetings, plus a home tour of Historical Marshall, and dine at the world famous Win Schulers. Details and reservations: Goodrich, 117 Parrott Drive, Marshall, Michigan.

LAFAYETTE LA
MAR 5-6

The Lafayette Amateur Radio Club is holding its 17th Annual Hamfest and Banquet on March 5th and 6th. This event attracts hundreds of amateur radio operators throughout the south. For more information contact Lafayette Amateur Radio Club, 413 Kim Drive, Lafayette LA 70501.

STERLING IL
MAR 6

The Sterling-Rock Falls Amateur Radio Society Hamfest-77 will be held Sunday, March 6, 1977 at the Sterling High School Field House, 1608 4th Avenue, Sterling, Illinois. Free coffee and donuts 7:30-8:30 am. All indoor facilities and plenty of room. Plenty of parking area, including parking lot to accommodate campers and mobile trailers. First table free, second and third table $5.00 each. Limit three tables to a party or bring your own. Lots of prizes. For tickets and reservations for more than one table, write Don Van Sant WA9PBS, 1104 5th Avenue, Rock Falls IL 61071. Make checks payable to Sterling-Rock Falls Amateur Radio Society. Talk-in on 146.94 simplex. Advance tickets $1.50, door tickets $2.00.

PHOENIX AZ
MAR 6

The Winter Hamfest will be held March 6 at South Mountain Park at the south end of Central Avenue, Phoenix. Featuring swap meet, eyeball and pot luck. Sponsored by the Amateur Radio Council of Arizona.

BRIDGMAN MI
MAR 6

Blossomland Amateur Radio Association will hold the 11th Annual Spring Swap-Shop, Sunday, March 6th at Bridgman Middle School gym, Lake St. at Tower, Bridgman, Michigan. Exit 16 on I-94. Expanded facilities, refreshments, prizes, and fun. Talk-in on 22/82 and 94. Table space restricted to radio and electronic items only. Advance ticket donation $1.50. Tables $2. Write: John Sullivan, PO Box 345, St. Joseph MI 49085. Make checks payable to Blossomland A.R.A.

NORTH TONAWANDA NY
MAR 15

The Amateur Radio Association of the Tonawandas Annual Auction and Flea Mart will be held March 15th at 7 pm, at the Payne Avenue Christian Church, Payne Avenue, North Tonawanda, New York. Please tag all gear to be sold with seller's name or call, and minimum opening bid. If you have gear to sell please bring it. Admission free.

MAUMEE OH
MAR 20

The Toledo Mobile Radio Association, Inc. is sponsoring its 22nd Annual Ham Auction, Sunday, March 20, 1977 at the Lucas County Recreation Center, Maumee (Toledo), Ohio. Auction, flea market, commercial displays and good eyeball QSOs. Time: 8 am to 5 pm. Admission: $2 advance, $2.50 after March 1, 1977 or at the door. Talk-in on 52-52 and all Toledo area repeaters. Send SASE, Toledo Mobile Radio Association, Inc., Box 7548, Oregon OH 43616.

WHITEWATER WI
MAR 20

The Tri County ARC (Whitewater, Wisconsin) Hamfest will be held March 20, 1977 in the Whitewater Armory. Donation: $1.50 in advance, $2 at the door. Reserved tables $2 in advance. Write Doc Walters WB9EMR, 81 N. Main Street, Fort Atkinson WI 53538.

MIDLAND TX
MAR 26

The Midland Amateur Radio Club will have a Swap Fest on Saturday and Sunday, March 26th and 27th. It will be held in the County Exhibit Building on Highway 80, just East of Midland, Texas. Pre-registration will be $3.50 per person, and $4.00 at the door. Please send pre-registration fees to Midland Amateur Club, Box 4401, Midland TX 79701. There will be lots of door prizes.

EAST RUTHERFORD NJ
MAR 26

The Knight Raiders VHF Club presents its world famous Auction and Flea Market to be held at St. Joseph's Church in East Rutherford, New Jersey on Saturday, March 26, 1977. Free admission — free parking. Refreshments are available. Flea market tables: in advance — $5 for full table, or $3 for half table; at door — $6 for full table, or $3.50 for half table. For further information call Bob Kovaleski at 473-7113 (evenings only). Talk-in on 146.52. Send reservations and checks payable to Knight Raiders VHF Club, Inc., PO Box 1054, Passaic NJ 07055 (reservations close March 20).

CHARLOTTE NC
MAR 26-27

The 5th Annual Metrolina Hamfest will be held Saturday, March 26 from 12 pm to 6 pm, and Sunday, March 27 from 8 am to 4 pm. New location this year: North Carolina National Guard Armory, Douglas Municipal Airport, Charlotte NC. Door prizes: both Saturday and Sunday. Tickets: $3.00. Talk-in 34/94, W4BFB. For further information write: Mecklenburg Amateur Radio Society, 2425 Park Road, Charlotte NC 28209.

GRAND RAPIDS MI
APR 2

The Third Annual Swap and Shop will be held at the Northeast Jr. High School, 1400 Fuller Ave., N.E., Grand Rapids, Michigan, on Saturday, April 2 from 9 am to 5 pm in the cafeteria. Featured will be: CBs, monitors, ham equipment and electronic parts. For further information contact Grand Rapids React at the above address.

COLUMBUS GA
APR 2-3

The Columbus, Georgia Hamfest will be held April 2 and 3, Palm Sunday weekend, at the Fine Arts Building at Fairgrounds, 9 am to 4 pm daily. Flea market, ham auction, prize drawing at 1:30 pm Sunday, talk-in 28/88, 3975 kHz, buffet dinner Sat. at 8 pm. For more information write K4JNL. Advance tickets: K3MTY/4, Rt 5, Box 750, Phenix City AL 36867.

ST. CLAIR SHORES MI
APR 3

The South Eastern Michigan Amateur Radio Association is holding its Nineteenth Annual Hamfest on April 3, 1977 from 8 am EST to 3 pm EST. It will be held at the South Lake High School in St. Clair Shores, Michigan, 21900 Nine Mile Road and Mack Avenue. For further information contact Dorothy Spilski WB8PRJ, Secretary S.E.M.A.R.A., 11906 Riad Avenue, Detroit, Michigan 48224, 313-521-6646.

MOBILE AL
APR 16-17

The Mobile Amateur Radio Club will hold its annual Ham Fest and Computer Fest on April 16 and 17th — all the newest equipment on display, computers too. Swap & Shop all day Saturday from 9 to 5, banquet at 7 pm, doors open Sunday at 9 am, prizes, drawing at 1 pm. Activities for the ladies and children, campsites available, over 1500 people expected, the biggest Fest on the Gulf Coast. For more information contact Marvin Upshaw K4BVG, 512 Tuttle Avenue, Mobile AL 36604.

LIBERTY MO
APR 23-24

The P.H.D. Amateur Radio Assn., Inc., of Liberty MO (Kansas City area) will sponsor the Eighth Annual Northwest Missouri Hamfest on Saturday and Sunday, April 23 and 24, 1977 at the Kansas City Trade Mart, Exhibit Hall 2 (Municipal Airport terminal building). There will be a complete program of forums both days, a large

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5 SO239 UHF chassis female	$3.50	1 UG224/U UHF splice	$2.45
5 UG175/U adaptor	$1.20	1 UG363/U UHF splice	$2.75
5 UG176/U adaptor	$1.20	3 UG260/U BNC male	$2.70
2 PL259PO push-on UHF male	$2.75	3 UG1094/U BNC chassis female	$2.40
2 PL258 UHF splice	$2.10	1 Lightning Arrester in-line UHF	$2.25
1 M358 UHF "T"	$2.80		

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number of commercial exhibits, swap tables, YL-XYL program. Doors open from noon to 6 pm on Saturday, April 23; and from 9 am to 5 pm on Sunday, April 24. Setup time for commercial and swappers will be from 10 am to noon on Saturday. There will be a Saturday night banquet at the world famous Gold Buffet, with ARRL president Harry Dannals W2HD, as guest speaker. Pre-registration is $2, admission at the door will be $2.50. Pre-registration including banquet is $8. Talk-in on 146.34/.94 and 3.925 MHz. For information and pre-registration write to: PHD Amateur Radio Assn., PO Box 11, Liberty MO 64068.

SULLIVAN IL
APR 24

The Moultrie Amateur Radio Klub will have its 16th Annual Hamfest Sunday, April 24th at Wyman Park, Sullivan, Illinois. Heated indoor area and large outdoor parking area. No charge to vendors. For information write: MARK Radio Klub, PO Box 327, Mattoon IL 61938. Talk-in 146.94.

AMBOY IL
APR 24

The Rock River Radio Club Hamfest will be held April 24, 1977 at Amboy, Illinois (Lee County), at the 4H Center, Routes 30 and 52. Same place as last year. Tickets $1.00 advance. $2.00 at gate. Camper parking available at a nominal fee. Write: Carl Karlson W9ECF, Nachusa IL 61057. Indoor and outdoor facilities.

LAS CRUCES NM
APR 24

The Mesilla Valley Radio Club sponsors Whitey's Bean Feed and Swap-Fest Sunday, April 24th, at 10 am. Located near Las Cruces, New Mexico at La Mesa with talk-ins on 16-76, 04-64 and 3940 kHz. Fun for all the family with big prizes, plenty of food and the usual beverage truck. All included for $5.00 for adults, $1.75 for kids. Eat, drink and win a prize with Whitey K5ECQ as host. Free overnight parking at grounds so come for a spell. All correspondence should be made to: Thomas B. Rapkock Jr., 640 W. Las Cruces Avenue, Las Cruces NM 88001.

DAYTON OH
APR 29

The 8th Annual FM B*A*S*H will be held on the Friday night of Dayton Hamvention, April 29, 1977, at the Dayton Biltmore Towers (hotel), Main at First Streets, from 8 pm til midnight. Admission is free to all hams and their friends. Sandwiches, beverages, snacks and C.O.D. bar will be available. A live floor show will be presented by TV personality Rob Reider WA8GFF and his group. It will be followed at 11 pm by a fabulous prize drawing featuring an Icom IC-245 and many others. See you where the action is!

MEADVILLE PA
MAY 7

The Third Annual Northwestern Pennsylvania Hamfest will be held May 7 at Crawford County Fairgrounds, Meadville PA. Free admission. Flea market begins at 10 am. $2 to display — hourly door prizes — refreshments — commercial displays welcome. Indoors if rain. Talk-in 146.04/64 and 146.52. Details C.A.R.S., PO Box 653, Meadville PA 16335.

BINGHAMTON NY
MAY 7

The 18th Annual STARC Hamfest will be held Saturday, May 7, 1977 at Binghamton, New York. Take exit 71N from NY-17, go 3.8 miles north on Stella-Ireland Road. Flea market, tech talks, hourly door prizes. General admission $2.00/person. Banquet by pre-reservation at $6.00/person. Indoor exhibit space by pre-registration at $5.00 per table. Outdoor exhibit flea market space free. Talk-in 146.22/82 and 94/94. For details and reservations, contact STARC, PO Box 11, Endicott NY 13760.

NEW YORK NY
JUN 12

The 4th Annual Hall of Science A.R.C. Flea Market and Hamvention. Dealers booths, test bench, refreshments, zoo, museum. A fun day for the whole family. Sunday, June 12 (rain date June 19), 9 am to 3 pm. Admission: $2.00. Free parking. Directions: .34/.94 repeater; information: (212) 699-9400.

PLAIN CITY OH
AUG 14

Hamfest 77 is to be held on Sunday, August 14, 1977 at the Plain City Fairgrounds, Plain City OH. Talk-in on 146.16/76 or 146.52. Advance tickets $1.50 — gate $2.00. For additional information or reservations, write UCARC, 13613 U.S. 36, Marysville OH 43040, or call Gene Kirby W8BJN 513-642-9861.

ERIE PA
AUG 27

The 2nd Annual Erie Ham Jam will be held Saturday, August 27, 1977 at the Erie County Fieldhouse, Route 8 (Parade Street) and I-90. Flea Market — large indoor display area — forums — camping and motels nearby. For more information contact RAE Ham Jam, Box 844, Erie PA 16512.

MADISON WI
SEPT 25

The 5th Annual Madison Swapfest will be held Sunday, September 25 at Dane Co. Expo Center Youth Building, Madison WI. Rain or shine — inside facilities — doors open at 8 am. 12,000 sq. ft. of electronic equipment and components for hams, computer hobbyists and experimenters. Bring the whole family for delicious food and entertainment. Excellent overnite camping accommodations. Tickets — advanced $1.50; at door $2.00. Tables — advanced $2.00; at door $3.00. Make check or money order payable to M.A.R.A. — mail to M.A.R.A., Box 3403, Madison WI 53704. Reservations must be in by Sept. 10, 1977.

Ham Help

Let me congratulate you for the progress that the *73 Magazine* has made. You have struck me with lightning three times. My son Gurbux Singh at Rochester (WB9TTN) will take care to ground the electrical buildup. I have passed your *73* to a lot of people and it has been a pastime with me to read over and over again some of the articles. Your September issue arrived yesterday and was wonderful. You made history and let me congratulate Sherry Smythe for the wonderful photographs.

Wayne ... could you put me on "Wanted Help" column? We need radio magazines and other reading matter. Please do not send any equipment for amateur radio is still under suspension. Our license is however renewed.

Let me wish you more success and when are we two going to have an eyeball QSO? 73 to *73*.

Tara Singh
XZ2KN and XZ2TA (mobile)
187 Eden St.
Rangoon, Burma

I am interested in getting my ham ticket. Please enter my name and address in your Ham Help column. Thank you.

Norman Malinky
405 W. Walnut St.
Painesville OH 44077
216-352-4162

I am in the service, and in Germany, CB is going to the birds more than ever. I'm enclosing my order for your set of *73* tapes, and will need help pretty soon. I've heard that the Conditional class license is no longer available. How can I get my license if this is true? I'm stationed in Augsburg and hope there is a ham nearby. I've even gone to the extent of getting a credit account with SWAN.

SP5 Tim Y. Woo
483d Med. Det. (Vet Svc)
Augsburg, FRG
APO New York 09178
Phone (2582)-4484

I am trying to get into the CW world, but only have old equipment, some working, some not. I need the following: (1) instructions (literature) for Lysco, mod. 600 xmtr; (2) i-f can, coils (parts) for Hammarlund mod. HQ-110 receiver.

I'll be glad to send $1.00 for postage to the first ham to help me out.

Dale McMindes PJ4DM
T.W.R. Box 37
Bonaire,
Netherlands Antilles

I badly need the schematic and owner's manual for the HQ-100 general coverage receiver.

Robert M. Johnson
36 Wolcott St.
Camden NY 13316

I read the article in the December issue about the Friden-8800 problem, and since that time I have acquired one of these things. I was quite wary for a while, as if something went awry with the electronics, I would be up the creek. The only thing that the vendor supplied was the operational manual, which tells you how to change the ribbon, etc.

Well, after much hunting, I was able to locate some more information on the thing, and I am sure that others will be glad to hear of it. I have schematics of printed circuit boards, with interconnecting wiring data, power supply schematics, and all other data which will help anyone in solving logic problems within the unit. I am offering these copies at $6.00, which includes shipping. This is done mostly on a cost basis and shipping.

Tim Ahrens WA5VQK/5
2200 Sorret Tree Ct.
Austin TX 78744

You are my last hope. Can you please put my letter in your Ham Help column? I subscribe to your magazine and reading the article on those hams in Weisbaden (Oct., 76), I tried to contact them! No answer. If you have any info that can help me, that would be great!

I am looking for an American ham who is stationed or living in Germany and is licensed to operate in that country who can help me get my license over here. I am a special radio and electronic devices repairman for the Army. On my last leave, I didn't have enough time to get my ticket. I've been trying feverishly for a year and all my leads have been dead ends. I still have 3 years over here! PLEASE HELP ME!!! Anyone.

PFC Robert Milback
504th Maint. Co.
71st Maint. BN
APO NY 09139

Anyone know how to improve the receiver section of the Swan 350?

Is there such an animal as a wideband low gain preselector? This circuit would have to be inserted between the antenna relay and the rf amp tube of the receiver section and be capable of covering 80 through 10 meters. I would like a small circuit which could be mounted inside the transceiver housing.

Thank you.

Lloyd Gosa WB8TNC
1423 Upland Dr.
Kalamazoo MI 49001

I have obtained a set of wiring diagrams (45 sheets) for the Friden TM20K715 and TM20K714 printer and controller, and I am interested in sharing the information. The cost would depend on how many people are interested and, hopefully, if enough people want copies, the cost would be about $35.00.

Bill Dries
1908 Parmenter
Middleton WI 53562

Repeater Update

Compiled by Stan Miastkowski WA1UMV

ARIZONA			
WR7AHJ	Phoenix	53.96	IN 52.96
WR7AIM	Tucson	146.94	Autopatch
FLORIDA			
WR4AUR	Sarasota	146.73	
GEORGIA			
WR4AZU	Cedartown	147.72	
WR4AYM	Toccoa	52.525	IN 52.025
HAWAII			
WR6	Kailua	146.76	
ILLINOIS			
WR9AIU	Peoria	146.97	Autopatch
WR9ACS	Jacksonville	147.00	
WR9AAA	Joliet	146.82	
WR9AAA	Joliet	223.82	IN 222.22
WR9AAA	Joliet	442.20	IN 447.30
WR9AIA	Park Ridge	146.64	PL
INDIANA			
WR9ADI	Fort Wayne	146.76	
WR9ADA	LaPorte	146.61	Autopatch
WR9AFN	Logansport	147.18	
WR9AFN	Logansport	146.94	
WR9AEG	Indianapolis	146.97	Autopatch
WR9AEP	Indianapolis	147.06	Autopatch
KENTUCKY			
WR4ANE	Hawesville	146.88	
MICHIGAN			
WR8ANT	Cadillac	146.97	
WR8AJV	Belleville	146.94	Autopatch
MINNESOTA			
WRØADT	Fridley	146.67	PL
WRØAKF	Shoreview	146.73	PL
WRØAMS	Andover	147.06	
MISSOURI			
WRØAHX	Kansas City	146.97	
NEW JERSEY			
WR2AOA	Belmar	146.775	
WR2AGK	Franklin Lakes	146.79	
WR2AMC	Titusville	224.82	
WR2	Toms River	147.255	
NEW MEXICO			
WR5AQR	Santa Fe	444.20	IN 449.20
NEW YORK			
WR2ANN	Fredonia	53.57	IN 52.57
WR2ACF	Fredonia	146.67	
WR2AMB	Fredonia	146.85	Autopatch
WR2AHK	Farmingdale	147.135	
WR2AMD	Jericho	146.50	IN 147.50
WR2AKC	Staten Island	147.045	
WR2AHX	Manhattan	147.27	
WR2AJJ	White Plains	146.775	
NORTH CAROLINA			
WR4AJX	Indian Trail	147.90	IN 147.30 VOX
WR4AJG	Jacksonville	147.00	Autopatch
WR4AON	Rocky Mount	147.12	Autopatch
PENNSYLVANIA			
WR3AFZ	Pittsburgh	147.09	Autopatch
WR3AFZ	Pittsburgh	444.40	IN 449.40
WR3AHR	Lancaster	224.90	IN 223.30
WR3ABE	Philadelphia	52.64	IN 52.72/52.76
WR3ABE	Philadelphia	443.80	IN 448.80
WR3AFQ	Acme	146.67	Autopatch
WR3AIJ	Sharon	147.15	Autopatch
SOUTH CAROLINA			
WR4AQY	Orangeburg	147.09	Autopatch
TENNESSEE			
WR4AGX	Nashville	146.94	
WR4ANU	Germantown	147.09	Private
WR4ADO	Kingsport	146.76	Autopatch
WR4AXQ	Bristol	147.00	IN 147.60
WR4AFS	Chattanooga	147.00	
TEXAS			
WR5AET	Houston	146.82	
WR5AJY	Houston	147.21	
WR5AFK	Houston	147.09	Autopatch
WR5	Dallas	147.09	
WR5	Seguin	147.21	

Oscar Orbits

Oscar 7 Orbital Information				Oscar 6 Orbital Information				
Orbit	Date (Mar)	Time (GMT)	Longitude of Eq. Crossing °W	Orbit	Date (Mar)	Time (GMT)	Longitude of Eq. Crossing °W
10478 B	1	0134:03	76.0	NA 20003 BTN	1	0144:55	85.8
10490 AX	2	0033:24	60.8	NA 20015 BTN	2	0044:51	70.8
10503 B	3	0127:41	74.4	N 20028	3	0139:46	84.5
10515 A	4	0027:01	59.2	NA 20040 BTN	4	0039:42	69.5
10528 B	5	0121:19	72.8	N 20053	5	0134:38	83.3
10540 A	6	0020:39	57.7	S 20065	6	0034:34	68.3
10553 Q	7	0114:56	71.2	N 20078	7	0129:30	82.0
10565 A	8	0014:17	56.1	NA 20090 BTN	8	0029:26	67.0
10578 BX	9	0108:34	69.7	NA 20103 BTN	9	0124:21	80.8
10590 A	10	0007:54	54.5	N 20115	10	0024:17	65.8
10603 B	11	0102:11	68.1	NA 20128 BTN	11	0119:13	79.5
10615 A	12	0001:32	52.9	N 20140	12	0019:09	64.5
10628 B	13	0055:49	66.5	S 20153	13	0114:05	78.3
10641 A	14	0150:06	80.1	N 20165	14	0014:01	63.3
10653 B	15	0049:27	64.9	NA 20178 BTN	15	0108:56	77.0
10666 X	16	0143:44	78.5	NA 20190 BTN	16	0008:52	62.0
10678 B	17	0043:04	63.4	N 20203	17	0103:48	75.8
10691 A	18	0137:22	76.9	NA 20215 BTN	18	0003:44	60.8
10703 B	19	0036:42	61.8	N 20228	19	0058:40	74.5
10716 A	20	0130:59	75.4	S 20241	20	0153:36	88.3
10728 Q	21	0030:20	60.2	N 20253	21	0053:31	73.3
10741 A	22	0124:37	73.8	NA 20266 BTN	22	0148:27	87.0
10753 BX	23	0023:57	58.6	NA 20278 BTN	23	0048:23	72.0
10766 A	24	0118:14	72.2	N 20291	24	0143:18	85.8
10778 B	25	0017:35	57.1	NA 20303 BTN	25	0043:14	70.8
10791 A	26	0111:52	70.6	N 20316	26	0138:10	84.5
10803 B	27	0011:13	55.5	S 20328	27	0038:06	69.5
10816 A	28	0105:30	69.1	N 20341	28	0133:02	83.3
10828 B	29	0004:50	53.9	NA 20353 BTN	29	0032:58	68.3
10841 AX	30	0059:07	67.5	NA 20366 BTN	30	0127:53	82.0
10854 B	31	0153:25	81.1	N 20378	31	0027:49	67.0

The listed data tells you the time and place OSCAR crosses the equator in an ascending orbit for the first time each day. To calculate successive orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the first crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world, it will descend over you. To find the equatorial descending longitude, subtract 166 degrees from the ascending longitude. To find the time it passes the north pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR when it is within 45 degrees of you. The easiest way to do this is to take a globe and draw a circle with a radius of 2480 miles (4000 kilometers) from the home QTH. If it passes right overhead, you should be able to hear it for about 24 minutes total. OSCAR will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15 degrees from you, add another minute; at 30 degrees, three minutes; at 45 degrees, ten minutes.

OSCAR 6: Input 145.85-145.95 MHz; Output 145.90-146.00 MHz; Output 29.40-29.50 MHz. OSCAR 7 Mode A: Input 29.45-29.55 MHz; Telemetry beacon at 29.45 MHz. Mode B: Input 432.125-432.175 MHz; Output 145.925-145.975 MHz.

Orbits designated "X" are closed to general use. "ED" are for educational use. "BTN" orbits contain news bulletins. "Q" orbits have a ten Watt erp limit. "L" indicates link orbit. "N" or "S" indicates that Oscar 6 is available *only* on northbound or southbound passes. Satellites are not available to users on "NA" days.

DIODES/ZENERS

1N914	100v	10mA	.05
1N4004	400v	1A	.08
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.03
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45	ww	.75
24-pin	pcb	.35	ww	1.25
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.95

Molex pins .01 To-3 Sockets .25

2 Amp Bridge 100-prv 1.20

25 Amp Bridge 200-prv 2.50

TRANSISTORS, LEDS, etc.

2N2222	NPN			.10
2N2907	PNP			.15
2N3740	PNP	1A	60v	.25
2N3906	PNP			.10
2N3055	NPN	15A	60v	.50

LED Green, Red, Clear .15

D.L. 747 7 seg 5/8" high 1.95

XAN72 7 seg com-anode 1.50

FND 359 Red 7 seg com-cathode 1.00

C MOS

4000	.20
4001	.20
4002	.25
4004	4.95
4006	1.20
4007	.40
4008	1.20
4009	.25
4010	.45
4011	.20
4012	.25
4013	.40
4014	1.10
4015	.95
4016	.35
4017	1.10
4018	1.10
4019	.70
4020	.85
4021	1.35
4022	1.15
4023	.25
4024	.95
4025	.35
4026	1.95
4027	.50
4028	.95
4030	.45
4033	1.95
4034	2.45
4035	1.25
4040	1.35
4042	.95
4043	1.25
4044	.95
4046	1.50
4049	.80
4050	.70
4066	1.35
4069	.40
4071	.35
4082	.45

— T T L —

7400	.15
7401	.15
7402	.20
7403	.25
7404	.15
7405	.25
7406	.45
7407	.55
7408	.25
7409	.15
7410	.15
7411	.25
7412	.30
7413	.65
7414	1.10
7416	.25
7417	.50
7420	.15
7426	.40
7427	.45
7430	.15
7432	.45
7437	.45
7438	.35
7440	.25
7441	1.15
7442	.65
7443	.95
7444	.95
7445	.95
7446	.95
7447	.95
7448	1.20
7450	.25
7451	.25
7453	.25
7454	.25
7460	.40
7470	.45
7472	.45
7473	.35
7474	.40
7475	.45
7476	.20
7480	.65
7483	1.00
7485	1.05
7486	.40
7489	2.50
7490	.40
7491	1.15
7492	.95
7493	.45
7494	1.25
7495	.85
7496	.95
74100	1.85
74107	.45
74121	.40
74122	.55
74123	.55
74125	.45
74132	1.35
74141	1.30
74150	1.00
74151	.95
74153	.95
74154	.75
74156	1.15
74157	.75
74161	1.25
74163	1.25
74164	.95
74165	1.50
74166	1.35
74175	.95
74176	1.25
74180	.85
74181	3.25
74182	.95
74190	1.75
74192	1.65
74193	.85
74194	1.45
74195	.95
74196	1.50
74197	1.25
74198	2.35
74367	.85
75108A	.35
75110	.35
75491	.50
75492	.50
74H00	.25
74H01	.25
74H04	.25
74H05	.25
74H15	.30
74H20	.30
74H22	.40
74H30	.25
74H40	.25
74H52	.15
74H53J	.25
74H55	.25
74H72	.55
74H101	.75
74H103	.75
74H106	.95
74L00	.35
74L02	.35
74L03	.30
74L10	.35
74L30	.45
74L47	1.95
74L75	.55
74S00	.55
74S02	.55
74S03	.50
74S10	.45
74S11	.45
74S20	.50
74S40	.30
74S51	.45
74S64	.30
74S74	.50
74S112	1.50
74S133	.45
74S140	.75
74S151A	.45
74S153	.45
74S158	.45
74S194	1.50
74S257 (8123)	.25
74LS00	.45
74LS01	.45
74LS02	.45
74LS04	.55
74LS08	.45
74LS09	.45
74LS10	.45
74LS11	.45
74LS20	.50
74LS21	.25
74LS22	.25
74LS32	.55
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JUNE 63. Surplus issue: DMO-2 Beacon Tx on 220, increasing ARC-2 transceiver selectivity, PE-97A pwr supply conversion, BC-348 bandspread, inductance tester, converting BC-230 tx, beginner's rx using BC-453, recvr motor-tuning, transistor cw monitor, BC-442 ant relay conversion, mobile loading coils, increasing Two-er selectivity, TV with the ART-26 tx, TRC-8 rx on 220, ARC-5 hf rx & tx, ARC-3 tx on 2M.

AUG 63. Battery-op 6M stn, diode noise gen, video modulation, magic T-R switch, ant gain, halo mods, cw breakin, VEE beam design, coax losses, RF wattmeter, TX Tube Guide, diode pwr supply, "Lunchbox" squelch, SWR explanation, vertical ant info, info on Windom ant.

OCT 63. WBFM transceiver ideas, HF propagation, cheap tone patch, remote-tuned Yagi, construction hints, ant coupler, 95 Vertical, filament xformer construction, 2M nuvistor converter, Lafayette HE-35 mods, Buyer's Guide to Rx & Tx, product detector, novel Hi-C VFO, radio astronomy, panadaptor "if" converter, compact mike amp.

FEB 64. 2M multichannel exciter, rx design ideas, majic t/r switch, loudspeaker enclosures, 40M 2W tx, look at test equipment, radio grounds, 40M ZL Special ant, neutralization.

MAY 67. Quad Issue: 432 Quad-quad-quad, expanded HF quad, Two el quad, miniquad, 40M quad, quad experiments, half-quad, three el quad, 20M quad, tiltover quad, easy-to-erect quad, Quad Bibliography, FET vfo, tube troubleshooting, HF dummy load, understanding "dB," HF SSB/cw rx, geometric circuit design, GSB-201 transceive, FET converter for 10-20M, hi-pass rx filters.

JULY 67. VE ham radio, VE9 hams, dsb adaptor, home brew tower, transistor design, '39 World's Fair, gnd plane ant, G4ZU beam, SSTV monitor, UHF FET preamps, IC "if" strip, vertical ant, VHF/UHF dipper, tower hints, scope monitoring, operating desk, S-Line crossband, hi-school ham club, Heath HR-10 mods.

OCT 67. HF solid state rx, rugged rotator, designing slug-tuned coils, FET converter, SSTV pix gen, VHF log-periodics, rotatable dipole, gamma-match cap, old-time dxing, modern dxing.

JUNE 68. Surplus Issue: Transformer tricks, BC-1206 rx, APS-13 ATV tx, low voltage dc supply, surplus scopes, FM rig commercial xtal types, Wilcox F-3 rx, restoring old equipment, 75A1 rx mods, TRA-19 on 432, freq counter uses, transceiver pwr supply, uses for cheap tape recorders, Surplus Conversion Bibliography, RT-209 walkie on 2M, ARC-1 guard rx, RTTY tx-TU.

JULY 68. Wooden tower construction, tiltover towers, erecting a telephone pole, IC AF osc, "dB" explained, ham club tips (Part 1).

SEPT 68. Mobile vhf, 432 FET preamps, converting TV Tuners, xtal osc stability, parallel Tee design, moonbounce rhombic, 6M exciter (corrections Jan 69), 6M transceiver (corrections Jan 69), 2M deb amp, ham club tips (Part 3).

NOV 68. SSB xtal filters, solid state trouble-shooting, IC freq counter (many errors & omissions), "cv" transformers, space, comsonaddyssey, pulsar info, thin-wire ants, 40M transistor cw tx/rx, BC-348M double conversion, multifunction tester, copper wire specs, thermistor applications, hi-voltage transistor list, ham club tips (Part 5).

JAN 69. Suppressor compressor, HW-12 on 160, beam tuning, AC voltage control, 2M transistor tx, LC power reducer, spectrum analysis info, 6M transistor rx, operating console, RTTY autostart, calculating osc stability, lo-pwr 40 cw tx, sequential relay switching, sightless operator's bridge, ham club tips (Part 7).

FEB 69. SSTV camera mod for fast-scan, tri-band linear, selective af filter, unijunction transistor info, Nikola Tesla biography, mobile installation hints, extra-class license study (Part 1).

MAR 69. Surplus issue: TCS tx mods, cheap compressor/amp, RXZ calculations, transistor keyer, better balanced modulator, transistor oscillators, using blowers, halfwave feedline info, Surplus Conversion Bibliography, extra license study (Part 2).

APR 69. 2-channel scope amp, rx preamp, Two-er PTT, variable DC load, SWR bridge, 100 kHz marker gene, some transistor specs, SB-610 monitorscope mods, portable 6M AM tx, 2M converter, extra license study (Part 3).

MAY 69. 2M Turnstile, 2M Slot, rx attenuator, generator filter, short VEE, quad tuning, using antennascope, measuring ant gain, phone patch regs, SWR indicator, 160M short verticals, 15M antenna, HF propagation angles, FBK exciter, KW dummy load, hi-power linear, extra license study (part 4), all-band curtain array.

JUNE 69. Microwave pwr generation, 6M sab tx, 432-er tx/rx, 6M converter, 2M 5/8 wave whip, UHF tv tuners, ATV video modulator, UHF FET preamps, RTTY monitorscope, extra license study (part 5), building uhf cavities, mini-VEE for 10-20M, vhf vfo.

JULY 69. AM modulator, SSTV sig gen, 6M kw linear, 432 KW amp, 432-er tx/rx, 6M IC converter, radio-controlled models, RTTY IC TU, audio notch filter, VRC-19 conversion, tube substitution, 2M transistor xciter, extra license study (part 6), hi FET vfo.

AUG 69. FET regen for 3.5 MHz up, FM crystal switching, 5/8 wave vertical, introduction to ICs, RTTY tone gen, good/bad transistor checker, 2M AM tx, measure transistor Ft, 160M propagation, triac applications, simple IF sweep gen, transistor keyer, SB-100 on 6M, xtal freq measurement, extra license study (part 7), FM deviation meter, qrp am 6M tx, circular quads, FM noise figure, transistor parameter tracer.

SEPT 69. Tunnel diode theory, majic tee, soldering techniques, wave travel theory, cable shielding, transistor theory, AM noise limiter, AFSK gen, transistor amp debugging, measure meter resistance, diode-stack pwr supply, transistor testing, 2½W 6M tx, HX-10 neutralizing, capacitor useage, radio propagation, AM mod percentage, extra class license study (part 8), 3-400Z linear, ATV vidicon camera, 2 transistor testers, FET compressor, rf plate choke.

OCT 69. Super gain 40M ant, FET chirper, telephone info, scope calibrator, thyrector surge protector, slower tuning rates, identify calibrator harmonics, FM adaptor for AM tx, CB sets on 6M, proportional control xtal oven, xtal filter installation, Q-multiplier, transceiver pwr supply, extra class study (part 9).

NOV 69. NCX-3 on 6M, IF notch filters, dial calibration, HW32A external VFO, 6M converter, feedline info, rf t-bridge, fm mobile hints, umbrella ant, 432-er tx (part 1), pwr supply tricks with diodes, transistor keyer, transistor bias design, xtal vhf sign gen, electronic variac, SB33 mods, extra class study (part 10), SB34 linear improvements.

DEC 69. Transistor-diode checker, dummy load/attenuator, tuned filter chokes, bandswitching Swan 250 & TV-2, 80mh selectivity, match exciters, rtl xtal calibrator, transistor pa design, hw mobile p.s., 1-10 gHz freqmeter, CB rig on 6M, extra license study (part 11), 1970 buyer's guide.

JAN 70. Transceiver accessory unit, bench power supply, SSTV color method, base-tuned center-loaded ant, 6M bandpass filter, extra license study (part 12, rectifier diode useage, facsimile info.

FEB 70. 18-inch 15M dipole, 6M converter, high-density pc board, camper-mobile hints, 2M freq synthesizer, encoding/decoding for repeaters, DX-35 mods, panoramic vhf rx, variable-Z HF mobile mount, extra license study (part 13), linear IC info, qrp 40M tx, IC Q-multiplier.

MAR 70. Gdo applications, charger for drycells, FM freq meter, pc board construction, ham fm standards, cheap rf wattmeter, multifreq fm osc, "IF" system modules (part 1), Six-er mods, gdo dip lite, Motorola 41V conversion, cw monitor, buying surplus logic, SBO-22A sonobuoy conversion, GRC-9 rx/tx conversion, extra class study (part 14), intro to vhf fm.

APR 70. Noise blanker, 2M hotcarrier diode converter, repeater controller, understanding COR repeater, 7/8-wave 2M ant, extra class study (part 15), inexpensive semiconductors, removating surplus meters, linear amp bias regulator, hi performance if amp & agc system, SSB bfo for shortwave radio, vacuum tube load box, general fm dope & repeater guide, megging your ant.

MAY 70. Comments on "fm docket" #18803, future of cw, fm-am rx aligner, 5/8-wave verticals, using 2M intelligently, auto burglar alarms, pwr supplies from surplus components, "IF" system modules (part 2), vhf FET preamps, educated "idiot" lites, postage-stamp 6M tx, extra class study (part 16), Bishop IFNL, low-band police monitor, mobile cw tx, Wichita auto-patch.

JUNE 70. DDRR ant, vfo circuit, remote SWR indicator, indoor hf vertical, two rx on one antenna, environment & coax loss, 2-el trap verticals, buying surplus, two 40M qrp tx, 21dB 2M beam, extra class study (part 17).

DEC 70. Solid-state vhf exciter, delta-fire control for SSB, 2M transistor FM tx, HW100 offset tuning, "little gate" dipper, 3-500Z hi linear, general class study (part 9), "transi-test" (no good — errors!), transistor p.s. current limiter.

JAN 71. Split fones for dxing, Heath Ten-er mods, cw duty cycle, repeater zero-beater, HEP IC projects, 10-15-20M parabolic ideas, lightning protection, IC rx accessory, attic ants, double-balanced mixers, permanent marker tool, ham license study questions.

FEB 71. Metal locator, varactor theory, AFSK unit, SSTV patch box, ATV hints, RTTY tuning indicator, tone encoder/decoder, 220 MHz converter, SSTV magnetic deflection, IC code osc, 6M tx beeper, general class study (part 8), RTTY intro, perf-board terminal, low-ohmmeter.

MAR 71. IC audio filter, IC 6M converter, trap vertical ideas, digi counter info, surplus equipment identification, hf linear, simple tone patch, repeater audio mixer, digi RTTY accessories, coathanger gndplane, general class study (part 7).

APR 71. Intro to fm, noise blanker, repeater problems, Motorola HT mods, microwave repeater linking, digital ID unit, tuneable 2M fm rx/tx, repeater directory, fm marketplace, meter evaluator, varactor modulator, simple sig gen, touchtone hookup, hf preselector, 10M 12W tx.

MAY 71. 75M mobile whip, 2M preamp, transistor amp design, 10M dsb tx, portable fm transceiver directory, audio compressor clipper, transistor LM freqmeter, 450 MHz link tx, simple af filter, 1-tube 2M transceiver, surplus 2M power amp, general class study (part 8).

JUNE 71. 2M beam experiments, 3 el 2M quad, multi-band dipole patterns, weather balloon vertical, pocket-pager squelch, two-er vfo, tuning mobile whips, transistor pwr supply, capacity decode box, 40M gain ant, general class study (part 9).

JULY 71. IC audio processor, audio sig gen, cw filter, 2M fm osc, 2M collinear vertical, FM supplier directory, Motorola G-strip conversion, transistor beta tester, general class study (part 10).

AUG 71. Ham facsimile (part 1), 500 Watt linear, dimensions for July collinear, 4-tube 80/40 station, vfo digi readout, Jupiter on 15M, general class study (part 11), pink ticket wavemeter.

SEPT 71. Transformerless power supplies, solid state tv camera, IC substitution, two rf wattmeters, IC compressor-amp, multichannel HT-200, ham facsimile (part 2), causes of manmade noise, vio with tracking mixer, general class study (part 12), transistor heatsinking, IC pulse gen, fone-patch isolation, hod wattmeters.

OCT 71. Emergency repeater car, transceiver power supply, predicting meteor showers, digi switching, repeater current battery charger, passive repeaters, earth grounds, audio "tailoring" filters, Swan 350 mods.

NOV 71. 3-el 75M beam, motor-tuned gndplane, 2M gain vertical, transistor biasing, split-site repeater, fax-hunting, audio filter, transistor/diode tester, xtal tester, 6M kw amp, 10-15-20M quad, transistor pi-net final, ant feedline, communications dbs, 2300 MHz exciter.

AUG 72. SSTV intro, speech processor, fm repeater info, test probe construction, GE progline ac supply, 432 rf testing, preamp-compressor, Six-er mods, fone patch, Two-er info, solar info, SCR regulator for HVPS, "ideal" xtal osc, fm rx adaptor, auto theft alarm.

SEPT 72. Plumbicon tv camera, WWVB 60 kHz rx, cigartube sig gen, cw active filter, rf testing at 1296-3500 GHz, balun ant feed, transistor power supply, IC 6M rx, IC fm/am detector (part 2), active filter design (part 3), K2OAW freq counter (part 3), 2M freq synthesizer (part 1).

OCT 72. Corrections for Aug. fm rx adaptor, 2M freq synthesizer (part 2), 6M transistor vfo, nano-ampere meter, time-freq measurement (part 1), active filter design (part 4), repeater timer, extra-class Q&A (part 3), balloon vertical, ID gen, time delay relay, 432 filter ideas, DC-AC inverter, hc-diode converter, rtl decade and nixie driver, plus minus supply for ICs.

NOV 72. Hf transistor power amps, RTTY selcal, IC trf rx, transistor keyer, emergency power, 220 MHz preamp, double-delta ant, simple converter using modules, hf RF tester, "lumped line" osc, 2M freq synthesizer (part 3), K2OAW counter errata, 2M preamp, extra class Q&A (part 4), hi-Z voltmeter, Nikola Tesla story, vhf swr meter, transistor regen rx, 432 SSB transverter, AC arc welder, intro to computers, hybrid am modulator, HR10 rx mods, 10M transistor am tx, 40M gndplane, IC logic demonstrator, overload protection, rf/rf sweep generator, digi freq counter, aural rx tuning.

DEC 72. SSTV scope analyzer, 2M fm rx, tone burst encoder and decoder, universal if amp, autopatch hookup, LM380N info, voltage variable cap info, 2M 18 watt amp, SSB modulation monitor, xtal freq/activity meter, 10A var. dc supply, transmission line uses, radio astronomy, inductance meter, 75 to 20M transverter, LED info, 40M preamp, transistor vfo, 1972 index, 2M preamp.

JAN 73. HT-220 touchtone, 3-el 20M yagi, 50 MHz freq counter, speech processor, 2-tone gen, fm test set, tilt-over tower, 6M converter using modules, tuneable af filter, six band linear, 10M IF tuner, diode noise limiter, cw/ssb agc, HW22a transceiver 40M mod, HAL ID-1 mod.

FEB 73. CW id gen, tone operated relay, toroidal quadrature ant, active filter, time freq measurement (part 2), repeater timing control, SSTV circuits (part 1), 2M converter using modules, multifunction metering, FET biasing, freq counter preamp, TR22 hi-power mod, transistor rf power amps (part 1), light bulb rf power indicators, 75A4 filters, capacitance measurement, Gonset 201 mod, world time info.

APR 73. FM deviation meter, 2M FET preamp, two 2M power amps, repeater control (part 1), repeater licensing, European 2M fm, fm scanner adaptor, RCA CMU15 mods, lightning detector, cb elimination bridge, transistor rf power amps (part 2), repeater economics.

JUNE 73. 220 MHz sig gen, uhf power meter, repeater licensing info, RTTY autoswitch, 40M hybrid vfo-pa tx, ant polar mount, 10-15-20M quad, K2OAW counter mods, double coax ant, ham summer job, tone decoder, field strength meter, nicad battery pack, ohm meter, FCC regs (part 1).

AUG 73. Log-periodics (part 1), tone burst gen, rf power amp design, transistor radio intercom, 160M ant, SSTV monitor, low cost freq counter, VOM design, qrp 40M tx, 432 MHz exciter, fm audio processing, FCC regs (part 3).

SEPT 73. Repeater control system, log-periodics (part 2), 2M rx calibrator, PLL ic applications, TT pad hookup, Heath HWU "q" meter, Decade-6 doppler, 2M coaxial ant, 2M converter, IC keyer, measure ant Z, FCC regs (part 4).

OCT 73. GE Pocketmate mods, microwave freq measurement, CA3102E 2M frontend, 2 kw hf linear, rf wattmeter, meter repair, 60/40 dipole, IC "hi" gen, vhf freq multiplier, FCC regs (part 5).

NOV 73. 450 MHz exciter, intro to ATV circuits, nicad voltage monitor, autopatch connections, IC meter amplifier, TR22 ac supply, indoor vertical, IC af filter, momentary power failure protection, 160M ant coupler, Motorola HT info, SSTV ISB, Class-B af amp, FCC regs (part 6).

DEC 73. Code speed display, 2M kw amp, IC keyer, 8038 waveform gen, helical resonator design, sensitive rf voltmeter, proximity control switch, IC tester, sequential tone decoder, 2M portable beam, electronic calculator math, cw filter design, FCC regs (part 7).

FEB 74. SSTV monitor info, IC audio amps, scope sweep gen, 15/20M vertical, telephone line control system, pc board construction, var-Q af filter, blown fuse indicator, 40m cw stn with Ten-Tec modules, simple preamp-compressor, single-IC rx, "432-er" final assembly, transistor keying circuit, 7-segment readout with nixie driver.

APR 74. Vox for repeaters, tone operated relay, hf transverter, 10-to-2m tx converter, remote control panel for scanner, RCA fm tx tuning, subaudible tone gen, FCC regs (part 9), Repeater Atlas.

MAY 74. Cd car ignition, audio compressor info, interference suppression for boats, auto burglar alarms, 2m ic preamp, 10m fet converter.

JULY 74. 4-1000A linear, universal freq gen, universal afsk gen, 555 IC timer, 80M phased array, 135 kHz-432 MHz preamps, 10M qrp am tx, 3000 vdc supply, how to read diagrams.

AUG 74. Toroidal directional wattmeters, 450 MHz FET preamp, use gdo to find "c", Trimline tt pad hookup, R390 & R392 rx mods, tracking cw filter, aural voltmeter, universal regulated supply, satv scan converter, ttl logic problems, ID timer.

SEPT 74. MOSKEY electronic keyer (part 1), ex warning system, Heath 10-103 scope mods, qrp 6M am tx, rf speech clipper, audio noise limiter, wx satellite on SSTV monitor, universal IC tester, miniature rig construction, tower construction, infinite rf attenuator, electronic

(More)

Since there's little to get stale in back issues of 73 (our magazine is not padded ... like others ... with reams of activity reports), you'll have a fantastic time reading them. Most of the articles are still exciting to read ... and old editorials are even more fun for most of the dire predictions by Green have now come to pass. Incentive licensing was every bit the debacle he predicted ... and more. You'll really get a kick out of the back issues.

photo-flash ideas, IC "select-o-ject."

OCT 74. Microtransistor circuits, synthesized HT-220 (part 1), repeater government, regulated 5 vdc supply, fm selcal, removeable mobile ants, Motorola metering, 2M vertical collinear, Motorola model code, 2M coaxial dipole, 1.6 MHz if strip, MOSKEY electronic keyer (part 2), carbon mike circuit, hi-power lo-pass filter, 6M preamp, 3-wire dipole, ATV sync gen, NCX-5 mods, mobile whip for apartment dwellers, sstv auto vertical trig.

NOV 74. K2OAW counter update, regulated 5 vdc supply, wind direction indicator, synthesized HT-220 (part 2), 20M 3-el beam, autopatch pad hookups, double-stub ant match, novice class instruction, digi swr meter (part 1), 6M converter (1.6 MHz if), "C-bridge," MOSKEY electronic keyer (part 3), Aug. sstv scan converter errata, repeater off-freq indicator.

DEC 74. Care of nicads, wind speed/direction indicator, wx satellite video converter, electronic keyer, hints for novices, unknown meter scales, SSTV tape ideas, TTL logic probe, public service band converter, tuned-diode test receivers, digi swr meter (part 2), telephone pole beam support, rhombic antennas, 1974 Index.

FEB 75. Heath HO-10 scope mod for SSTV, electronic keyer, digital satellite orbital timer, Oscar 7 operation, satellite orbital prediction, Heath SB-102 mods, comparing FM & AM, repeater engineering, Robot 80-A sstv camera mod, neutralizing Heath SB-110A, "Bounceless" IC switch, tape keyer for cw tx.

APR 75. $50 walky for 2M, 2M scanning synthesizer, 88 mH toroid info, 8-function repeater controller, nicad battery precautions, TR22C preamp, telephone attachment regs, Guide to 2M Hand-held Transceivers, 2M 7-el beam, basic telephone systems (part 1), 10 min ID timer, modified hf Hustler mobile ant for 2M, 15M quad modified for 20M, 2M collinear beam, R-11A surplus rx conversion, 5/16-wave 2M ant, Hallicrafters SX-111 rx mods, 160M cw tx.

AUG 75. 146/432 MHz Helical ants (part 2), 10 min ID timer, digi swr computer (part 1), debugging rf feedback, DVM byer's guide, wx satellite monitor, cmos "accu-keyer," pc board method, sweep-tube final precautions, compact multiband dipoles, small digital clock, accessory vfo for hf transceiver, modern non-Morse codes, multi-function gen, 2M scanning synthesizer errata, KP-202 walky charger, 10M multi-element beam.

SEPT 75. Calculating freq counter, wx satellite FAX system (part 1), IC millivoltmeter, three-button TT decoder, troubleshooting sstv pix, 40M dx ants, 146/432 MHz helical ants (conclusion), digi swr computer (conclusion), reed relay for cw bk-in, NE555 preset timer, power-failure alarm, portable qrp rig power unit, precision 10 vdc reference standard, 135 kHz if strip, telephone handsets with fm transceivers, Motorola T-44 tx mod for ATV, 0-60 MHz synthesizer (part 10, ham radio PR).

OCT 75. A deluxe TTY keyboard (part 1), Op Amps: a basic primer, an introduction to microprocessors, 2m Synthesizer (conclusion), Satellite Fax System (conclusion), regulated supplies (dispelling the mystery), Digital Logic made simple, FCC interview, a contest uP system, digital clock time bases, the operating desk, QRP 432, ham PR.

NOV-DEC 75. Blockbuster double issue! Flip-flops exposed, breakthrough in fast scan ATV, strobing displays is cool, the tuned lunch box (antenna tuner for HF transceivers), a deluxe TTY keyboard (part 2), the 127' rotating mast, less than $100 multi-purpose scope for your shack (part 1), predicting third order intermod, feedline primer, QRMing the Third Reich, why tubes haven't died, instant circuits – build your own IC test rig, the K2OAW synthesizer PROM-oted, a ham's intro to microprocessing, Ground Fault Interrupter (a keep alive circuit for yourself), a $1 strip chart recorder, an even simpler clock osc., the Fun City surplus scene, updating the Heath IB-1101 counter, 256 pages!

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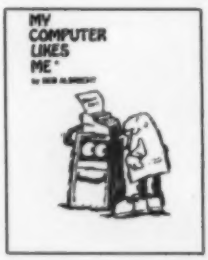

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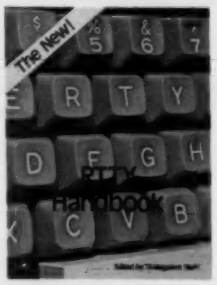

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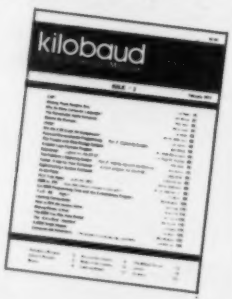

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6 WPM This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly – under pressure – faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five. Practice this one during lunch, while in the car, anywhere and you'll be more than prepared for the easy FCC exam.

13 WPM Code groups again, at a brisk 13 per so you will be at ease when you sit down in front of the steely eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test you'll thank heavens you had this back breaking tape.

20 WPM Code is what gets you when you go for the Extra Class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape. No one who can copy these tapes can possibly fail the FCC test. Remove all fear of the code forever with these tapes.

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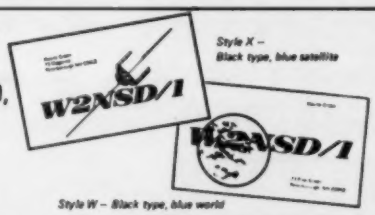

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Review

AUDIO FREQUENCY TESTERS
The 73 Test Equipment Library,
Published by 73, Inc., $4.95

This book, the second in the *73* series on test equipment for the radio amateur and experimenter, approaches the subject of audio frequency testing from every angle.

It is appropriate that this second book in this series be devoted to audio frequency test equipment, since this area plays such a large part in so many facets of amateur radio. From voice transmission (SSB, FM or AM) to ham TV, the precise measurement and generation of audio frequencies is essential to the testing and operation of all equipment. For the RTTY operator, whether he uses AFSK or FSK, this book should be invaluable for the proper maintenance of his station.

Through the 39 separate articles, the reader is instructed on how to build such items as audio sine wave generators, attenuators, two-tone generators for SSB testing, tone generators for RTTY, RTTY monitorscopes, SSTV and FSTV sync generators, oscilloscopes, and more.

No complete ham shack or workshop should be without a copy. There is no better source available on the subject for so reasonable a price or with such clear, concise easy-to-build projects.

Rich Force WB1ASL
Associate Editor

RADIO FREQUENCY TESTERS
The 73 Test Equipment Library,
Published by 73, Inc., $4.95

The generation of radio frequency waves is the one common denominator throughout all of ham radio. No matter what your specific interest in this fascinating hobby, without the correct generation and radiation of radio waves your enjoyment will be frustrated. In this book, which is the third in the *73* Test Equipment Library series, the editors of *73* have put together some of the best articles they could find, all aimed at assisting in achieving the best possible on-the-air signal.

With the inclusion of 77 articles, the book covers such subjects as swr measurement, rf impedance measurement, rf power measurement, field strength, frequency measurement, rf signal generators, crystal calibrators, grid dip oscillators, noise generators, attenuators, dummy loads, and more. Each subject is illustrated with various pieces of equipment which can be built to fit your specific needs.

By addition of this book to a station library, any ham can be well on his way to having one of the best signals on the band.

Rich Force WB1ASL
Associate Editor

HOW TO MAKE BETTER QSLS
by Jack Janicke K2JFJ,
Published by 73, Inc., $4.95

Jack Janicke in his new book published by *73* appeals to the artistically minded ham by guiding him on his way to making original unique QSL cards. Janicke contends, and it is true, that the "special" QSL is the one that gets answered first by DX stations. One chapter is devoted entirely to boosting QSL returns.

All types of printing processes are included, with special emphasis being placed on the silk screen method. Plans and pictures are included to allow the reader to construct, with the utmost ease, the necessary equipment for silk screening QSLs, as well as other items found around the normal ham station. Many other uses for the silk screen materials are explored.

This book should also appeal to the beginning art student, who is just starting into silk screening. All silk screen techniques are thoroughly covered.

In addition to silk screen, the methods for producing photographic, mimeograph, and letterpress cards are also examined. Janicke goes into detail on each.

So if the high cost of having "unique" QSLs has you down, try rolling your own, but first learn how from an expert in the book, "How to Make Better QSLs."

Rich Force WB1ASL
Associate Editor

DIGITAL INTEGRATED-CIRCUIT OPERATIONAL-AMPLIFIER AND OPTOELECTRONIC CIRCUIT DESIGN
Texas Instruments Electronics Series,
Published by
McGraw-Hill Book Company,
$16.50

If microprocessor design and interface techniques are your thing, Texas Instruments has the reference book you have been needing. More than just a collection of IC specifications and pinouts, "Digital Integrated-Circuit, Operational-Amplifier, and Optoelectronic Circuit Design" provides practical circuits and applications using the devices specified in the title. Eighteen chapters cover an entire range of devices, from introductory TTL and Schottky logic, counters, and converters, all the way to optoelectronic devices used in computer interfaces. If you have ever puzzled for hours over a tiny aspect of circuit design, the answer to your problem may rest in this book, a necessary addition to any computer hardware enthusiast's library.

John Molnar WB2ZCF
73 Magazine Staff

(the outside looks nice)
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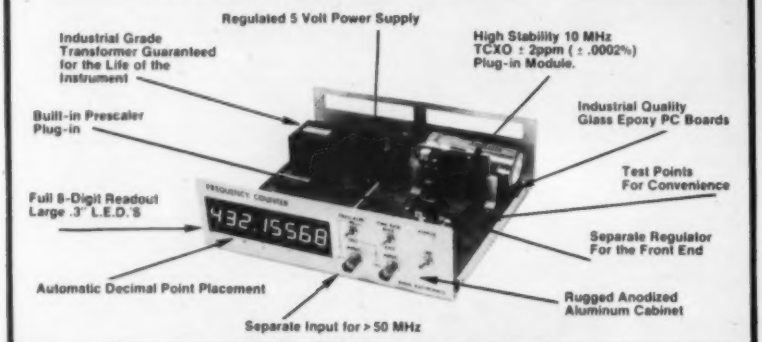
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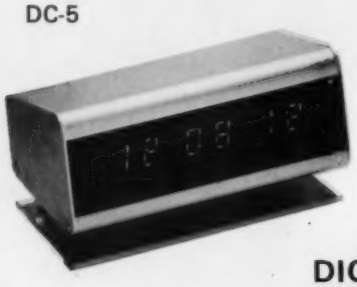

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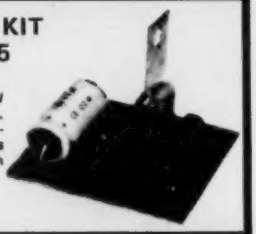

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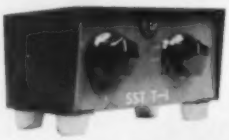

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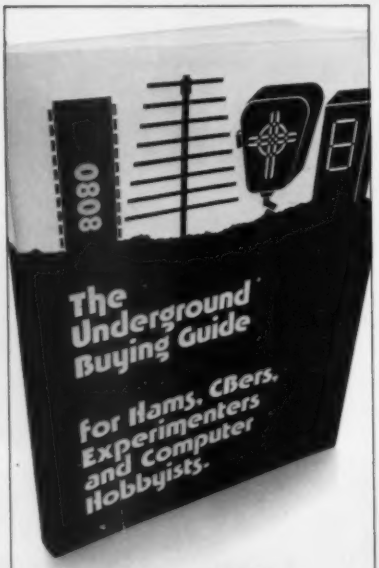

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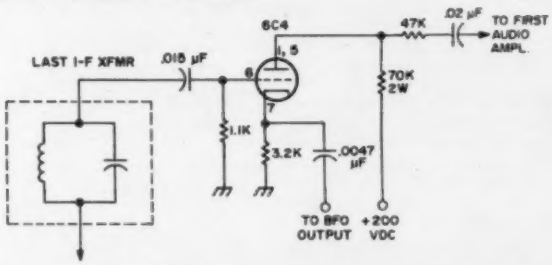
Novice Q&A

This column will be a monthly feature of 73 Magazine. It is hoped that it will be of assistance to beginners and old-timers alike. We only ask that your questions be kept as general as possible. We will try to answer all queries received. Please mail your questions to Technical Editor, 73 Magazine, Peterborough NH 03458.

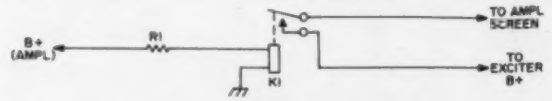


Q. Is there a practical SSB detector for most receivers?

A. The circuit in the figure is simple, but will not disturb the set. Your regular detector can be switched in or out and the simple detector used, or not. A stable bfo signal is required. This circuit will work with older receivers when the voltage to the bfo tube is stabilized.

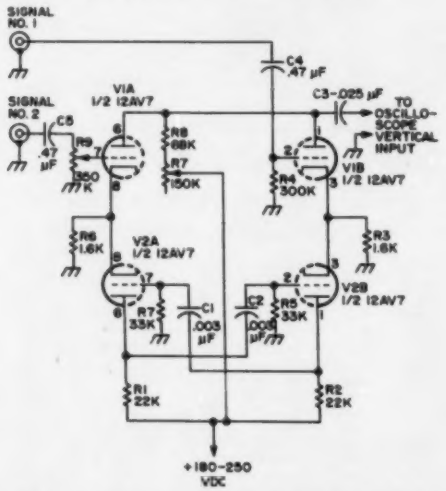
Q. What frequent check should be made of self-powered VTVMs?

A. From time to time the VTVM should be opened and the battery examined. It should be firmly seated in the holder and the battery contacts should not be corroded. Check the tightness of all bracket held-down screws. If you cannot zero-set the VTVM, replace the battery.



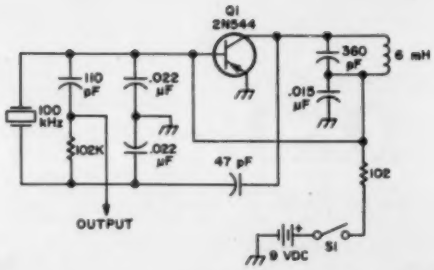
Q. How can amplifier screen voltage be removed during periods when the transmitter is operated with the final plate supply turned off?

A. The circuit in the figure permits safe operation of the amplifier screen-grid circuit when powered by the exciter supply. K1's coil is connected in series with the bleeder resistor (R1) for the amplifier's plate supply. Contacts are connected in series, with the lead running from the exciter supply to the amplifier screen circuit. In this manner, screen voltage is only applied to the final when the HV supply is turned on. Common 5k to 10k relays can be used. The value of R1 must be chosen for satisfactory bleeder operation plus an appropriate drop in B plus for the relay coil.



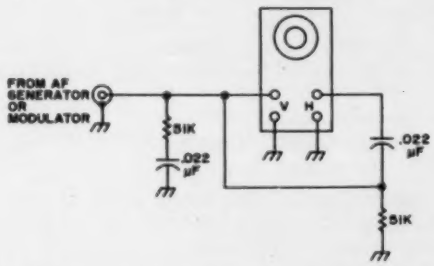
Q. Is it possible to see two signals simultaneously presented on a CRT screen by using a special type of electronic switch?

A. Refer to the figure. Two signals are alternately switched to one input of the scope so rapidly that you seem to "see" two presentations. But actually there is only one signal shown at a given time on the screen. This is a handy gadget for checking input and output waveforms.



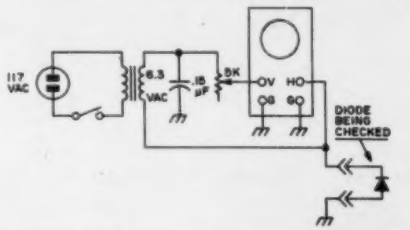
Q. How about a simple transistor 100 kHz calibrator for my ham band transceiver?

A. Refer to the figure. The output of this simple crystal calibrator should be connected at the receiver's antenna input side — not at the antenna terminal you would normally use.



Q. To get an elliptical pattern from an af generator, what is the proper method for connecting the scope?

A. Refer to the figure. Modulation can be added to the Lissajous pattern either on a vertical or horizontal form.



Q. Is there a simple scope setup to make it easy to check and match diodes?

A. When checking diodes of the same type, with the circuit in the figure, a comparison can be obtained by utilizing the same pot setting and noting the relative sizes of the traces obtained. Choice of a transformer is not critical. In addition to scope conventional traces, look for any indication of "fuzz" or ripple. Even if the basic trace seems good, do not rely on a diode exhibiting either fuzz or ripple.

Q. How can a transmitter be easily modified for CW operation?

A. By feeding an af oscillator into the mike jack, a transmitter can be used for CW operation. The oscillator can also feed a pair of phones for sidetone monitoring. The output of the keyed oscillator should be a good clean sine wave and care should be taken that the modulator is not overdriven.

Q. What causes the exciter meter to deflect to the left when the transmitter is on and the PTT is actuated?

A. A diode in the metering circuit may develop a reverse leakage which will permit some of the positive delay bias to appear in the exciter alc circuit. This causes down-scale deflection of the meter. To correct the condition, simply replace the diode with one which has a much higher voltage rating and it will block the delay bias completely.

Q. Regarding batteries: When should a mercury or a manganese battery be used?

A. Where long shelf life, steady output voltage and size are important, the mercury battery should be used. The manganese battery should be used only when you need both high surge capability and good shelf life. Both batteries are far superior to the old lead-zinc cells. Although more costly, the newer batteries are worth the price difference.

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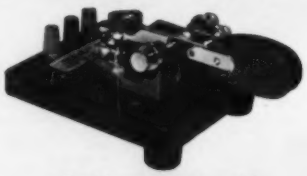

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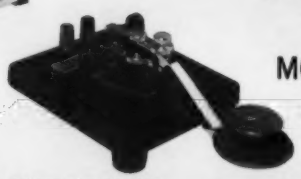

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15 for $1.98
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BARREL KIT #131 — TANTALUM ELECTROS
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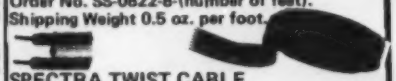

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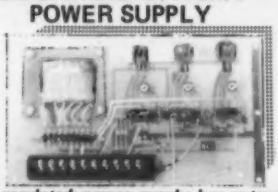
R4PDT110D	110VDC	11K	$2.00	$ 8.00

LOGIC AND OP. AMP. POWER SUPPLY



This regulated power supply has outputs of ±15 volts at 0.25 amps and +5 volts at 2.5 amps, input is 115 volts AC. Manufactured by a computer company as part of a phone data terminal. These units use three 723's (IC's) for regulation, and have barrier strip outputs. Power supplies are open frame, size: 5"x 9"x 2". New surplus, quanity is limited.
Sh. Wt. 5 Lbs . . . . .6MI60215 . . . . $17.50
3 for $45.00 . . . . .6MI60215 . . . . $45.00/3

INPUT/OUTPUT TERMINAL
GREAT FOR MICROPROCESSORS!

These units were part of a complex computer system. The terminal contains: ASC11 keyboard; CRT; drive circuits; and a complete 128 page tech. manual with operating and repair instructions, which makes it easy to modify the terminal for your applications. (Character generation unit was in a separate control device which is not supplied, but the terminal can be used with character generator LSI chips, such as the 2513 or 2516.)

The keyboard is a 50 key alpha-numeric (and others) block keyboard, with ASCII encoding. Display capacity is 768 (12 lines of 64), 384, 256, 128 and so on, depending on the size of characters desired. The character size may be adjusted from approximately typewriter size up to ¼".

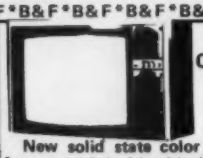
The viewing screen of the CRT utilizes a high contrast, low persistence, emerald green phosphor. Each character is composed from a 5x7 dot pattern, registering clearly and sharply against a dark background. Controls provided include: on/off; brightness; focus; and character height.

Great as a microprocessor input and output device. The display stations are used, from airline reservation systems, stock exchanges, hotel reservation systems, etc.
Shipping Weight 35 Lbs.
Order No.: 6NB60336 . . . . . $49.50 each
2 for $95.00 . . . . 6NB60336 . . . $95.00/2
4 for $180.00 . . . 6NB60336 . . . $180.00/4

CARD CAGE WITH GUIDES AND CONNECTORS

This cage has 37 P.C. board edge connectors for 1/16" thick cards. Connectors are wire wrap type with double edge contacts, 0.125" spacing. The card rack has 18 rows of 2 types of connectors: 30 contact and 86 contact types. Overall dimensions: 18" long; 11" wide; and 10" high. Reomved from used equipment, this was once part of a data display terminal.
Sh. Wt. 13 Lbs . . . . .5U00210. . . . . $9.50
3 for $25.00 . . . . .5U00210 . . . . $25.00/3

COLOR "TV" CHASSIS & PARTS



New solid state color TV chassis and parts for use with In-Line black matrix picture tubes. These are 1976 model sets, with the following features: micro-circuit technology; energy saver feature, one button color tuning AFC, low power consumption (less than a 100 watt light bulb).

We basicly have two chassis', the TS951 and the TS953, used to drive either 13", 15" or 19" picture tube. Parts to be added to the 19" chassis to make a complete TV include: UHF and VHF tuners, picture tube, tube shield, purity magnets, antenna, yoke, speaker, on-off switch, four 10K pots, binding posts and case.

Parts needed to make a complete 13" or 15" TV include: picture tube, tube shield, yoke, purity magnets, antenna, 2nd stage hi-voltage boost, binding posts, and case.

We do not have a complete package, but we do have some parts available at this time. By adding a picture tube, case and a few parts, you can have a going Color TV for less than half the price of a store bought set.

PRICE LIST

13" TV Chassis (with tuners and controls)
6Z60175. . . . . $49.50
15" TV Chassis (with tuners and controls)
6Z60174. . . . . $49.50
19" TV Chassis (no tuners, no controls)
6Z60172. . . . . $29.50
VHF Tuner (for 19" sets) . .6Z60303. . $8.50
UHF Tuner (for 19" sets) . .6Z60304. . $2.50
Antenna Telescope . . . .5MI00419 . . . $1.50
TV Speaker . . . . . .6Z60177. . . . . $3.50
Binding Post Assembly, UHF, VHF
4MI00422. . . . . $1.50

"C.B." POWER SUPPLY KIT
13.8 Volts D.C. @ 2.0 Amps

This easy to build kit is designed to give maximum RF output to your CB set. It delivers 10 to 24 VDC at 2 amps, fully adjustable and regulated by an IC circuit. Ideal as a CB power supply, lets you bring your rig indoors. Kit includes all parts and instructions to make up your own CB power supply, case not included. Also great as a regulated lab bench supply.
Sh. Wt. 10 Lbs . . . . 6C60498 . . . . $14.88
3 for $33.33 . . . . .6C60498 . . . . $33.33/3

0 to 24 V.D.C.; 5 A. POWER SUPPLY KIT
$14.50

This power supply or battery charger kit should be useful to have around the house. Simple and easy to build, complete kit includes a 0 to 40 volt autotransformer (Variac). 24V 5A transformer, bridge rectifier, filter cap, and everything else you need to build this hefty power supply (case not supplied). Complete with instructions.
Sh. Wt. 12 Lbs . . . . 6C60462 . . . . $14.50
3 for $38.88 . . . . .6C60462 . . . . $38.88/3
ALSO: A simple volt/amp meter kit to go with the above power supplies. Includes movement, instructions and resistors: add a faceplate and you have a nice meter to go with your supply.
Sh. Wt. 8 oz. . . . . 6C60463 . . . . . $2.00

B&F ENTERPRISES

119 FOSTER ST.
PEABODY, MA.
01960

PHONE ORDERS WELCOME!
BankAmericard, MasterCharge and American Express Accepted.
Phone: (617) 531-5774/532-2323

POSTAGE: Please add sufficient postage.

SEND FOR OUR FREE CATALOG!
Or, receive our catalog in an order and insure yourself of a place on our mailing list!

B&F

7400N TTL

SN7400N	.16	SN7459A	.25	SN74154N	1.00
SN7401N	.16	SN7460N	.22	SN74155N	.99
SN7402N	.21	SN7470N	.45	SN74156N	.99
SN7403N	.16	SN7472N	.39	SN74157N	.99
SN7404N	.18	SN7473N	.37	SN74161N	.99
SN7405N	.24	SN7474N	.32	SN74163N	.99
SN7408N	.39	SN7475N	.50	SN74164N	1.10
SN7407N	.29	SN7476N	.32	SN74165N	1.10
SN7408N	.25	SN7479N	5.00	SN74166N	1.10
SN7408N	.25	SN7480N	.59	SN74169N	1.25
SN7410N	.18	SN7482N	.99	SN74175N	1.50
SN7411N	.39	SN7483N	.70	SN74177N	2.10
SN7412N	.33	SN7485N	.89	SN74178N	2.40
SN7413N	.45	SN7486N	.39	SN74179N	2.40
SN7414N	.70	SN7489N	3.50	SN74181N	6.95
SN7416N	.35	SN7490N	2.49	SN74184N	1.95
SN7417N	.35	SN7491N	.99	SN74185N	2.20
SN7420N	.21	SN7491N	.75	SN74186N	15.00
SN7421N	.33	SN7492N	.49	SN74187N	6.00
SN7422N	.40	SN7493N	.49	SN74189N	3.95
SN7423N	.37	SN7494N	.79	SN74191N	1.19
SN7425N	.29	SN7495N	.79	SN74192N	1.25
SN7426N	.29	SN7496N	.89	SN74193N	.89
SN7427N	.32	SN7497N	4.00	SN74194N	1.25
SN7428N	.42	SN74100N	1.00	SN74195N	1.25
SN7430N	.26	SN74107N	.39	SN74197N	.75
SN7432N	.31	SN74121N	.39	SN74198N	1.75
SN7437N	.27	SN74122N	.39	SN74199N	1.75
SN7438N	.27	SN74123N	.50	SN74221N	1.25
SN7439N	.25	SN74125N	.69	SN74279N	.99
SN7440N	.15	SN74126N	.69	SN74283N	.89
SN7441N	.69	SN74132N	1.09	SN74284N	1.25
SN7442N	.59	SN74136N	.99	SN74285N	6.00
SN7443N	.75	SN74141N	1.15	SN74288N	1.25
SN7444N	.75	SN74142N	4.69	SN74297N	.75
SN7445N	.75	SN74143N	4.50	SN74298N	1.75
SN7446N	.81	SN74144N	4.50	SN74365N	1.25
SN7447N	.69	SN74145N	1.15	SN74366N	.75
SN7448N	.79	SN74147N	2.35	SN74367N	.75
SN7450N	.26	SN74148N	2.69	SN74393N	.89
SN7451N	.27	SN74150N	1.00	SN74LS00	.29
SN7453N	.27	SN74151N	.79	SN74LS05	.39
SN7454N	.20	SN74153N	.89	SN74LS08	.29

MANY OTHERS AVAILABLE ON REQUEST
25% Discount for 100 Combined 7400's

CMOS

CD4000	.25	CD4035	1.85	74C04R	.75
CD4001	.25	CD4040	2.45	74C10N	.65
CD4002	.25	CD4042	1.90	74C20N	.65
CD4005	2.50	CD4049	.45	74C30N	.85
CD4007	.25	CD4042	1.90	74C42N	2.15
CD4009	.59	CD4043	1.50	74C73N	1.50
CD4010	.59	CD4046	2.51	74C74	1.15
CD4011	.25	CD4047	2.75	74C80N	3.00
CD4012	.25	CD4048	.79	74C95N	2.00
CD4013	.47	CD4050	.79	74C107N	1.25
CD4016	.56	CD4051	2.95	74C151	2.90
CD4017	1.35	CD4053	2.95	74C154	4.00
CD4019	.55	CD4066	3.25	74C157	2.15
CD4020	1.49	CD4068	1.75	74C160	3.25
CD4022	1.25	CD4069	.45	74C161	3.25
CD4023	.25	CD4071	.45	74C163	3.00
CD4024	1.50	CD4081	.45	74C164	3.25
CD4025	.25	CD4511	2.50	74C173	2.80
CD4027	.69	CD4518	2.50	74C193	2.75
CD4029	1.65	CD4566	3.60	74C195	2.75
CD4029	2.90	74C00N	.39	MC4044	4.50
CD4030	.65	74C02N	.55	MC14016	.56

LINEAR

LM300H	.80			LM1310N	2.95
LM301H	.35			LM1414N	1.75
LM301CN	.35			LM1458C	.65
LM302H	.75	LM370N	1.15	LM1498N	.95
LM305H	.65	LM373N	3.25	LM1558V	1.65
LM307CN	.35	LM377N	4.00	LM2111N	1.95
LM308H	1.00	LM380N	1.39	LM2901N	2.95
LM308CN	1.00	LM380CN	1.05	LM3065N	.69
LM309H	1.10	LM381N	1.79	LM3900N	.55
LM309K	.89	LM382N	1.79	LM3905N	.69
LM310CN	1.15	NE501K	8.00	LM3909	1.25
LM311H	.90	NE510A	6.00	LM555BN	1.85
LM311N	.90	NE531H	3.00	MC5558V	1.00
LM318CN	1.50	NE536T	6.00	LM7525N	.90
LM319N	1.30	NE540L	6.00	LM7535N	.25
LM320K-5	1.35	NE550N	.79	8038	4.95
LM320K-5.2	1.35	NE555V	.70	LM7545D	.49
LM320K-12	1.35	NE5808	5.00	75451CN	.39
LM320K-15	1.35	NE561B	5.00	75452CN	.39
LM320T-5	1.75	NE562B	5.00	75453CN	.39
LM320T-5.2	1.75	NE565H	1.25	75454CN	.39
LM320T-6	1.75	NE565N	1.75	75491CN	.79
LM320T-12	1.75	NE568CN	1.25	75492CN	.89
LM320T-15	1.75	NE567H	1.95	75494CN	.99
LM320T-18	1.75	NE567V	1.50	RCA LINEAR	
LM320T-24	1.75	LM703CN	.45	CA3013	2.15
LM323K-5	9.95	LM709H	.29	CA3032	2.59
LM324N	1.80	LM709N	.29	CA3035	1.35
LM338N	1.70	LM710N	.79	CA3039	1.35
LM340K-5	1.55	LM711N	.39	CA3046	1.39
LM340K-6	1.55	LM723H	.55	CA3059	3.25
LM340K-8	1.55	LM723N	.55	CA3080	1.25
LM340K-12	1.55	LM733N	1.69	CA3080	.85
LM340K-15	1.55	LM739N	1.69	CA3081	2.00
LM340K-18	1.55	LM741CH	.35	CA3082	2.00
LM340K-24	1.55	LM741CN	.35	CA3083	1.80
LM340T-5	1.75	LM741-14N	.39	CA3085	.85
LM340T-6	1.75	LM747H	.79	CA3089	3.75
LM340T-8	1.75	LM747N	.79	CA3091	10.20
LM340T-12	1.75	LM748H	.39	CA3130	2.15
LM340T-15	1.75	LM748N	.39	CA3130	1.39
LM340T-18	1.75	LM1303N	.99	CA3140	1.25
LM340T-24	1.75	LM1304N	1.19	CA3080	1.75
LM350N	1.80	LM1305N	1.40	RCA195	9.95
LM351CN	.65	LM1307N	.65	RCA196	3.25

74LS00 TTL

74LS00	.29	74LS74	.49	74LS139	1.95
74LS02	.29	74LS75	.69	74LS151	1.55
74LS03	.29	74LS76	.49	74LS153	1.69
74LS04	.35	74LS85	.69	74LS157	1.55
74LS05	.35	74LS86	.49	74LS162	2.25
74LS08	.39	74LS93	1.75	74LS163	2.25
74LS10	.29	74LS95	2.49	74LS164	1.95
74LS13	.69	74LS96	.49	74LS175	1.95
74LS14	1.75	74LS90	1.25	74LS181	3.69
74LS20	.29	74LS92	1.25	74LS190	2.85
74LS26	.39	74LS93	1.25	74LS191	2.85
74LS27	.39	74LS95	1.95	74LS192	2.85
74LS28	.39	74LS96	1.89	74LS193	2.85
74LS30	.29	74LS107	.59	74LS194	1.89
74LS32	.39	74LS109	.59	74LS195	1.69
74LS40	.39	74LS112	.59	74LS257	1.75
74LS51	.29	74LS132	1.25	74LS260	.55
74LS55	.29	74LS136	.59	74LS279	.79
74LS73	.49	74LS138	1.89	74LS670	3.95

CLOCK CHIPS

MM5309	6 Digit, BCD Outputs, Reset PIN.	$9.95
MM5311	6 Digit, BCD Outputs, 12 or 24 Hour	4.95
MM5312	4 Digit, BCD Outputs, 1 PPS Output	4.95
MM5314	6 Digit, 12 or 24 Hour, 50 or 60 Hz	4.95
MM5316	4 Digit, Alarm, 1 PPS Output	6.95
MM5318	Video Clock Chip, For Use With MM5841	9.95
CT7001	6 Digit, Calendar, Alarm, 12 or 24 Hour	5.95

DATA HANDBOOKS

7400	Pin-out & Description of 5400/7400 ICS	$2.95
CMOS	Pin-out & Description of 4000 Series ICS	$2.95
Linear	Pin-out & Functional Description	$2.95
ALL THREE HANDBOOKS $6.95		

FAIRCHILD TECHNOLOGY KITS

- Complete Specifications on back of each kit
- Packaged for WALL DISPLAY APPEARANCE
- Dealer's Inquires Invited — Price List Available

7205 - Stop Watch Chip $19.95

DIGITS

FTK0001	0.5" High Common Cathode Digit	$1.00
FTK0002	0.5" High Common Anode Digit	1.00
FTK0003	.357" High Common Cathode Digit	.75
FTK0004	0.8" High Common Cathode Digit	2.00
FTK0005	0.8" High Common Anode Digit	2.00

0.8" HIGH DISPLAY ARRAYS

FTK0010	12 Hour, 3½ Digit Clock Display	7.00
FTK0011	24 Hour, 4 Digit Clock Display	8.00

LED LAMPS

FTK0020	10 Red LED Lamps	1.00
FTK0021	5 Mixed Colored LED Lamps	1.00
FTK0022	10 LED Mounting Clips	1.00
FTK0023	5 Three Piece LED Mounting Adapters	1.00

PHOTO TRANSISTORS

FTK0030	5 Flat Lens Photo Transistors	1.00
FTK0031	5 Round Lens Photo Transistors	1.00
FTK0032	3 Flat Lens Photo Darlingtons	1.00
FTK0033	3 Round Lens Photo Darlingtons	1.00

PHOTO ARRAYS

FTK0040	9-Element Tape Reader Array	16.00
FTK0041	12-Element Card Reader Array	24.00
FTK0042	Reflective Opto Coupler	4.00

COUPLERS

FTK0050	3 General Purpose Opto Couplers	1.00
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MOS CLOCK CIRCUITS

FTK0400	Digital Clock/Calendar Circuit (FCM7001)	7.00
FTK0401	Digital Clock/Calendar with BCD Outputs (FCM7002)	7.00
FTK0402	Direct Drive Digital Clock Circuit with AC Output (FCM3817A)	5.00
FTK0403	Direct Drive Digital Clock Circuit with DC Output (FCM3817D)	5.00
FTK0405	Direct Drive Digital Clock/Calendar Circuit (FCM7015)	6.00

KITS

FTK0106	Automobile Clock Kit	40.00

DISCRETE LEDS

	.125" dia.			.98" dia.			.98" dia.	
XC208	Red	10/$1		XC111	Red	10/$1
XC209	Green	4/$1		XC111	Green	4/$1
XC209	Orange	4/$1		XC111	Yellow	4/$1
				XC111	Orange	4/$1

	.200" dia.			.185" dia.			.200" dia.			.085" dia.	
XC22	Red	10/$1	XC525	Red	10/$1	XC556	Red	10/$1	MV30		
XC22	Green	4/$1	XC526	Green	4/$1	XC556	Green	4/$1	.085" dia. Micro		
XC22	Yellow	4/$1	XC526	Yellow	4/$1	XC556	Yellow	4/$1	red LED		
XC22	Orange	4/$1	XC526	Orange	4/$1	XC556	Orange	4/$1	5/$1		
SSL-22	RT	4/$1	XC526	Clear	4/$1	XC556	Clear	7/$1			

SPECIAL * — XC556 Red 100/$8.00 1000/$80.00 — SPECIAL *

DISPLAY LEDS

DL707 DL338

TYPE	POLARITY	HT		TYPE	POLARITY	HT	
MAN 1	Common Anode	.270	2.95	MAN 3820	Common Anode-orange	.300	1.75
MAN 2	5 x 7 Dot Matrix	.300	4.95	MAN 3640	Common Cathode-orange	.300	1.75
MAN 3	Common Cathode	.125	.99	MAN 4710	Common Anode-Red	.480	1.95
MAN 4	Common Cathode	.167	1.95	DL701	Common Anode-rad ±	.300	.99
MAN 7	Common Anode	.300	1.25	DL704	Common Cathode	.300	.99
MAN 7A	Common Anode-green	.300	1.95	DL707	Common Anode	.300	.99
MAN 7Y	Common Anode-yellow	.300	1.95	DL 726	Common Cathode	.500	1.95
MAN 52	Common Anode-green	.300	1.75	DL 747	Common Anode	.600	2.25
MAN 64	Common Anode-red	.400	1.75	DL 750	Common Cathode	.600	2.49
MAN 72	Common Anode	.300	1.25	DL 338	Common Cathode	.110	.98
MAN 74	Common Cathode	.300	1.50	FND70	Common Cathode	.300	.75
MAN 82	Common Anode-yellow	.300	1.75	FND503	Common Cathode	.500	1.69
MAN 84	Common Cathode-yellow	.300	1.75	FND507	Common Anode	.500	1.69

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100		1-24	25-49	50-99
8 pin	$.17	16	15	24 pin	$.30	.27	.26
14 pin	.20	19	18	28 pin	.45	.44	.43
16 pin	.22	21	20	36 pin	.69	.59	.58
18 pin	.28	.28	.27	40 pin	.63	.62	.61
22 pin	.37	.36	.35				

SOLDERTAIL STANDARD (TIN)

14 pin	$.27	.25	.24	28 pin	$.99	.99	.81
16 pin	.30	.27	.25	36 pin	1.39	1.26	1.15
18 pin	.35	.32	.30	40 pin	1.59	1.45	1.30
24 pin	.49	.45	.42				

SOLDERTAIL STANDARD (GOLD)

8 pin	$.30	.27	.24	24 pin	$.79	.63	.57
14 pin	.39	.32	.32	28 pin	1.19	1.09	.99
16 pin	.39	.35	.32	36 pin	1.75	1.49	1.26
18 pin	.52	.47	.43	40 pin	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	.41	.37	24 pin	$1.85	.95	.85
14 pin	.39	.38	.37	28 pin	1.48	1.25	1.10
16 pin	.43	.42	.41	36 pin	1.99	1.45	1.30
18 pin	.75	.60	.52	40 pin	1.75	1.55	1.40

Plastic Push Button Switch

- 18 AWG Solid Wire - 5" Long
- .56 (wide) X .80 (high) ¼-27 Thread
- 6 AMP @ 14 Volt - 1 AMP @ 110 Volt

		1-9	10-Up
J-100-1	Push On-Push Off	.59	.49
J-100-2	Normally Open	.59	.49
J-100-3	Normally Closed	.59	.49

MINATURE TOGGLE SWITCH

JMT-221	DPDT	on/off/on	$1.95
JMT-223	DPDT	on/none/on	$1.75
JMT-121	SPDT	on/off/on	$1.50
JMT-123	SPDT	on/none/on	$1.25

CLIPLITE

NEW LED MOUNTING SYSTEM — to be used with XC556 LEDS — SPECIFY COLORS — RED — GREEN — AMBER — YELLOW

SPECIAL 8/$1.49

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

ASST. 1	5 ea.	10 OHM 27 OHM	12 OHM 33 OHM	15 OHM 39 OHM	18 OHM 47 OHM	22 OHM 56 OHM		1/4 WATT 5% - 50 PCS.
ASST. 2	5 ea.	68 OHM 180 OHM	82 OHM 220 OHM	100 OHM 270 OHM	120 OHM 330 OHM	150 OHM 390 OHM		1/4 WATT 5% - 50 PCS.
ASST. 3	5 ea.	470 OHM 1.2K	560 OHM 1.5K	680 OHM 1.8K	820 OHM 2.2K	1K 2.7K		1/4 WATT 5% - 50 PCS.
ASST. 4	5 ea.	3.3K 8.2K	3.9K 10K	4.7K 12K	5.6K 15K	6.8K 18K		1/4 WATT 5% - 50 PCS.
ASST. 5	5 ea.	22K 56K	27K 68K	33K 82K	39K 100K	47K 120K		1/4 WATT 5% - 50 PCS.
ASST. 6	5 ea.	150K 390K	180K 470K	220K 560K	270K 680K	330K 820K		1/4 WATT 5% - 50 PCS.
ASST. 7	5 ea.	1M 2.7M	1.2M 3.3M	1.5M 3.9M	1.8M 4.7M	2.2M 5.6M		1/4 WATT 5% - 50 PCS.
ASST. 8R	Includes Resistor Assortments 1-7 (350 PCS.)							$10.95 ea.

$5.00 Minimum Order — U.S. Funds Only
California Residents — Add 6% Sales Tax

Spec Sheets - 25¢ — Send 24¢ Stamp for 1977 Catalog
Dealer Discount Available — Request Pricing

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- Battery Operated (Size C)
- Weighs ONLY 11 Ounces
- Wraps 30 AWG Wire onto Standard DIP Sockets (0.25 inch)
- Complete with built-in bit and sleeve

$34.95
(batteries not included)

WIRE-WRAP KIT — WK-2-W

WRAP • STRIP • UNWRAP

- Tool for 30 AWG Wire
- Roll of 500 ft. White 30 AWG Wire
- 50 pcs. each 1", 2", 3" & 4" lengths — pre-stripped white wire

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WIRE WRAP TOOL WSU-30

WRAP • STRIP • UNWRAP - $5.95

WIRE WRAP WIRE — 30 AWG

25 ft. min. $1.25 50 ft. $1.95 100 ft. $2.95 1000 ft. $15.00
SPECIFY COLOR — White - Yellow - Red - Green - Blue - Black

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THUMBWHEEL SWITCH ONLY

Part No.	Description	Price
SW-12	Decimal	3.00
SW-13	10 Position BCD only	3.00
SW-21	10 Position	3.00
SW-22	Decimal	3.00

Ordering: Order desired switch or switches and add necessary accessories for your particular application.

SW - Front Mount SR - Rear Mount

SERIES 57 Front Mount Assembly

SERIES 58 Rear Mount Assembly

ACCESSORIES

Part No.	Description	Price
SW-CP	End Plate (Part)	.50
SW-CPS	End Plate (Spec)	.50
SW-BB	Double Pole Insert	.40
SW-BB	Blank Body Insert	.40
SW-HB	Half Body Insert	.40

ACCESSORIES

Part No.	Description	Price
SW-CP	End Plate (Part)	.50
SW-CPS	End Plate (Spec)	.50
SW-BB	Double Pole Insert	.40
SW-BB	Blank Body Insert	.40
SW-HB	Half Body Insert	.40

Permacel Electrical Tape

- ¾" (wide) X 66 ft (long) • All weather • Not Imprint

$1.49 per roll — $12.50 per 10 roll package

ZENERS — DIODES — RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400mw	4/1.00	1N4005	600 PIV 1 AMP		10/1.00
1N751A	5.1	400m	4/1.00	1N4006	800 PIV 1 AMP		10/1.00
1N752	5.6	400m	4/1.00	1N4007	1000 PIV 1 AMP		10/1.00
1N753	6.2	400m	4/1.00	1N3600	50	250m	6/1.00
1N754	6.8	400m	4/1.00	1N4148	75	10m	15/1.00
1N959	8.2	400m	8/1.00	1N4154	35	10m	12/1.00
1N4050	15	400m	4/1.00	1N4305	75	25m	20/1.00
1N5232	5.6	500m	2/$	1N4734	5.6	1w	2/$
1N5235	6.8	500m	2/$	1N4735	6.2	1w	2/$
1N5235	6.8	500m	2/$	1N4736	6.8	1w	2/$
1N5236	7.5	500m	2/$	1N4738	8.2	1w	2/$
1N4956	25	40m	6/1.00	1N4742	12	1w	2/$
1N4956	130	7m	6/1.00	1N4744	15	1w	2/$
1N4954A	100	10m	6/1.00	1N1183	50 PIV	35 AMP	1.00
1N4001	50 PIV	1 AMP	12/1.00	1N1184	100 PIV	35 AMP	1.70
1N4002	100 PIV	1 AMP	12/1.00	1N1185	150 PIV	35 AMP	1.50
1N4003	200 PIV	1 AMP	12/1.00	1N1186	200 PIV	35 AMP	1.00
1N4004	400 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.00

SCR AND FW BRIDGE RECTIFIERS

C35D	15A @ 400V	SCR	$1.95
C35M	35A @ 200V	SCR	1.95
2N3228	1.6A @ 200V	SCR	.99
MDA 980-1	12A @ 50V	FW BRIDGE REC.	1.95
MDA 980-3	12A @ 200V	FW BRIDGE REC.	1.95

TRANSISTORS

MPS A05	5/$1.00	PN3567	3/$1.00	PN4249	4/$1.00
MPS A06	4/$1.00	PN3638	4/$1.00	PN4250	4/$1.00
2N3704	3/$1.00	PN3639	4/$1.00	2N4400	4/$1.00
2N3705	3/$1.00	PN3640	4/$1.00	2N4401	4/$1.00
PN3711	4/$1.00	PN3693	4/$1.00	2N4402	4/$1.00
2N3903	3/$1.00	2N3704	5/$1.00	2N4403	4/$1.00
2N3906	3/$1.00	2N3705	5/$1.00	2N5086	4/$1.00
2N3906A	4/$1.00	2N3706	5/$1.00	2N5087	4/$1.00
2N3707	5/$1.00	2N3708	5/$1.00	2N5088	4/$1.00
2N3708A	4/$1.00	2N3709	5/$1.00	2N5089	4/$1.00
2N3710	4/$1.00	2N3711	5/$1.00	2N5090	4/$1.00
2N3711	4/$1.00	2N3724	$.65	2N5091	4/$1.00
2N3725	3/$1.00	2N3725	3/$1.00	2N5092	4/$1.00
2N3903	3/$1.00	2N3903	5/$1.00	2N5138	3/$1.00
2N3904	3/$1.00	2N3904	4/$1.00	2N5139	3/$1.00
2N3905	3/$1.00	2N3905	4/$1.00	2N5210	3/$1.00
2N3906	3/$1.00	2N3906	4/$1.00	2N5551	3/$1.00
PN3563	$1.25	2N4013	3/$1.00	C106B1/C2R	2/$1.00
PN3565	5/$1.00	2N4014	3/$1.00	2N5432	50/.00
PN3566	5/$1.00	2N4123	10/$1.00		

CAPACITOR CORNER

DISC CAPACITORS — 50 VOLT CERAMIC

	1-9	10-49	50-100		1-9	10-49	50-100
10 pf	.05	.04	.03	.001µF	.05	.04	.035
22 pf	.05	.04	.03	.0047µF	.05	.04	.035
47 pf	.05	.04	.03	.01µF	.05	.04	.035
100 pf	.05	.04	.03	.022µF	.06	.05	.04
220 pf	.05	.04	.03	.047µF	.08	.06	.04
470 pf	.05	.04	.035	.1µF	.12	.09	.075

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% -50% DIPPED TANTALUMS (SOLID) CAPACITORS

1/35V	.38	.33	.17	1.5/35V	.38	.28	.21
.15/35V	.28	.23	.17	2.2/25V	.31	.27	.22
.22/35V	.28	.23	.17	3.3/25V	.31	.27	.22
.33/35V	.28	.23	.17	4.7/25V	.32	.28	.23
.47/35V	.28	.23	.17	6.8/25V	.36	.31	.25
.68/35V	.28	.23	.17	10/25V	.40	.35	.29
1.0/35V	.28	.23	.17	15/25V	.53	.37	.40

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

	Axial Lead			Radial Lead		
.47/50V	.15	.13	.10	.47/25V	.15	.13	.10
1.0/50V	.15	.14	.11	.47/50V	.15	.13	.10
3.3/50V	.15	.13	.10	1.0/16V	.15	.13	.10
4.7/25V	.16	.14	.12	1.0/25V	.16	.14	.11
10/25V	.15	.13	.10	1.0/50V	.16	.14	.11
10/50V	.16	.14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.16	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/50V	.25	.21	.19	10/25V	.15	.13	.10
100/25V	.24	.20	.18	10/50V	.16	.14	.12
100/50V	.35	.30	.28	47/50V	.24	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	.45	.41	.38	100/25V	.24	.20	.18
470/25V	.33	.29	.27	100/50V	.35	.30	.28
1000/16V	.33	.30	.25	220/16V	.23	.17	.14
2200/16V	.70	.62	.55	470/25V	.31	.28	.25

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Z–80 CPU CARD KIT FOR IMSAI/ALTAIR

$149. KIT

From the same people who brought you the $89.95 4K RAM kit. We were not the first to introduce an IMSAI/ALTAIR compatible Z–80 card, but we do feel that ours has the best design and quality at the lowest price.

The advanced features of the Z–80 such as an expanded set of 158 instructions, 8080A software compatibility, and operation from a single 5VDC supply, are all well known. What makes our card different is the extra care we took in the hardware design. The CPU card will always stop on an M1 state. We also generate TRUE SYNC on card, to insure that the rest of your system functions properly. Dynamic memory refresh and NMI are brought out for your use. Believe it or not, not all of our competitors have gone to the extra trouble of doing this.

As always, this kit includes all parts, all sockets, and complete instructions for ease of assembly. Because of our past experience with our 4K kit we suggest that you order early. All orders will be shipped on a strict first come basis. Dealers inquiries welcome on this item.

Kit shipped with 2 MHZ crystals for existing 500NS memory. Easily modified for faster RAM chips when the prices come down.

Z–80 Manual – $7.50 Separately.

Kit includes Zilog Manual and all parts.

JUMBO LED CAR CLOCK

$16.95 KIT

You requested it! Our first DC operated clock kit. Professionally engineered from scratch to be a DC operated clock. Not a makeshift kluge as sold by others. Features: Bowmar 4 digit .5 inch LED array, Mostek 50252 super clock chip, on board precision time base, 12 or 24 hour real time format, perfect for cars, boats, vans, etc. Kit contains PC Board and all other parts needed (except case). 50,000 satisfied clock kit customers cannot be wrong!

FOR ALARM OPTION ADD $1.50
FOR XFMR FOR AC OPERATION ADD $1.50

60 HZ CRYSTAL TIME BASE FOR DIGITAL CLOCKS
S.D. SALES EXCLUSIVE!

KIT FEATURES:

A. 60HZ output with accuracy comparable to a digital watch.
B. Directly interfaces with all MOS Clock Chips.
C. Super low power consumption. (1.5 ma typ.)
D. Uses latest MOS 17 stage divider IC.
E. Eliminates forever the problem of AC line glitches.
F. Perfect for cars, boats, campers, or even for portable clocks at ham field days.
G. Small Size, can be used in existing enclosures.

$5.95 or 2/$10.

KIT INCLUDES CRYSTAL, DIVIDER IC, PC BOARD PLUS ALL OTHER NECESSARY PARTS & SPECS

50HZ CRYSTAL TIME BASE KIT – $6.95

All the features of our 60HZ kit but has 50HZ output. For use with clock chips like the 50252 that require 50HZ to give 24 hour time format.

THIS MONTH'S SPECIALS!

SPECIAL

300.00 KHZ CRYSTAL – $1.50
8080A – CPU CHIP by AMD – $19.95
82S129 – 256 x 4 PROM – $2.50
N.S. 8865 OCTAL DARLINGTON DRIVERS 3 for $1.00
Z-80 – CPU by ZILOG – $69.95
MM5204 – 4K EPROM – $7.95

SPECIAL

Prices in effect this month ONLY!

4K LOW POWER RAM BOARD KIT
THE WHOLE WORKS – $89.95

Imsai and Altair 8080 plug in compatible. Uses low power static 21L02–1 500ns. RAM's, which are included. Fully buffered, drastically reduced power consumption, on board regulated, all sockets and parts included. Premium quality plated thru PC Board.

7400–19c	7411–29c	7451–19c	7490–65c	74153–75c
74LS00–49c	7413–50c	7453–19c	74LS90–95c	74154-1.00
7402–19c	7416–69c	7473–39c	7492–75c	74157–75c
74LS02–49c	7420–19c	7474–35c	7493–69c	74161–95c
7404–19c	7430–19c	74LS74-59c	7495–75c	74164-1.10
74L04–29c	7432–34c	7475–69c	7496–89c	74165-1.10
74S04–44c	7437–39c	7476–35c	74121-38c	74174–95c
74LS04-49c	7438–39c	7480–49c	74123-65c	74181-2.50
7406–29c	7440–19c	7483–95c	74132-1.70	74191-1.25
7408–19c	7447–85c	7485–95c	74S138-1.95	74192-1.25
7410–19c	7448–85c	7486–45c	74141-75c	74193-1.00
TTL INTEGRATED CIRCUITS				74195–69c

STICK IT! in your clock in your DVM, etc.!

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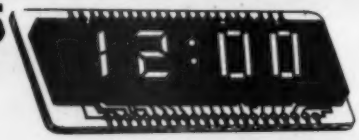

4 JUMBO .50" DIGITS ON ONE STICK! (with colons and AM/PM indicator)

BUY 3 for $10.

BOWMAR 4 DIGIT LED READOUT ARRAY

The Bowmar Opto-Stick. The best readout bargain we have ever offered. Has four common cathode jumbo digits with all segments and cathodes brought out. Increased versatility since any of the digits may be used independently to fit your applications. Perfect for any clock chip, especially direct drive units like 50380 or 7010. Also use in freq. counters, DVM's, etc. For 12 or 24 hour format.

UP YOUR COMPUTER!
21L02–1 1K LOW POWER 500 NS STATIC RAM
TIME IS OF THE ESSENCE!

And so is power. Not only are our RAM'S faster than a speeding bullet but they are now very low power. We are pleased to offer prime new 21L02–1 low power and super fast RAM's. Allows you to STRETCH your power supply farther and at the same time keep the wait light off.

8 for $12.95

$12.95 S.D. SALES EXCLUSIVE! **$12.95**
MOS 6 DIGIT UP-DOWN COUNTER

40 PIN DIP. Everything you ever wanted in a counter chip. Features: Direct LED segment drive, single power supply (12 VDC TYP.), six decades up/down, pre-loadable counter, separate pre-loadable compare register with compare output, BCD AND seven segment outputs, internal scan oscillator, CMOS compatible, leading zero blanking. 1MHZ. count input frequency. Very limited qty. WITH DATA SHEET

WESTERN DIGITAL UART
No. TR16028. 40 pin DIP
This is a very powerful and popular part.
NEW–$6.95 with data
LIMITED QUANTITY

RESISTOR ASSORTMENT
¼ W 5% and 10% PC leads. A good mix of values. 200/$2.

1702A 2K ERASEABLE PROM'S – $6.95
We tell it like it is. We could have said these were factory new, but here is the straight scoop. We bought a load of new computer gear that contained a quantity of 1702 A's in sockets. We carefully removed the parts, verified their quality, and are offering them on one heck of a deal. First come, first served. Satisfaction guaranteed! U.V. Eraseable.
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Our best seller. Includes miniature and standard sizes, single and multi-position units. All new, first quality, name brand. Try one package and you'll reorder more. **SPECIAL 12/$1.**

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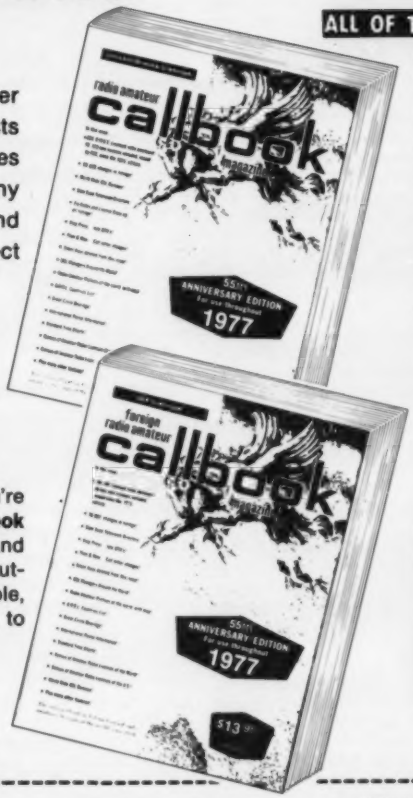

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Briefs

from page 21

Amateur Radio Club, will be sponsoring an AMSAT net on one of the club repeaters, WR2ADM–146.25/85, at 2000 hours local time, each Wednesday. The net will be educational as well as conversational with exchanges of information between net members. The basic objective of the net is to get complete operating information to new and potential OSCAR users.

In the near future, the net will also operate on 2m sideband at 145.70. Stations who are not located in the immediate area should aim their antennas toward Bellmore, L.I., located in Southcentral Nassau County. Net control is Hank WB2ALW with assistance from Barry WA2BOP. Thanks to WB2ALW.

Duane Hill of Peoria, Illinois, is the first new radio amateur in the United States to qualify for a special Bonus Award offered by Yaesu Electronics Corporation of Paramount, California.

Mr. Hill, who received his amateur license call letters, WB9YNQ, last month, entered amateur radio as a hobby for the first time last month. After purchasing a new Yaesu FT-221 two meter transceiver from Klaus Radio, Inc., in Peoria, he received a $25 bonus gift from Yaesu and was also reimbursed for the $4 license fee paid to the Federal Communications Commission.

Amateur radio operators offer many worthwhile services to their communities and the nation. Yaesu Electronics Corporation instituted its award plan as an added incentive to encourage shortwave listeners, CBers, and others to expand their interests into such services while being able to converse worldwide.

The idea of a 2 meter SSB DX contest proposed and promoted by Yaesu Electronics Corporation has been put to rest by the FCC. Yaesu had planned a one month contest in April that was to have offered thousands of dollars of prizes.

When the company approached the FCC field office in Los Angeles several months ago, they were told that officials there saw "nothing wrong with the idea." On that basis, Yaesu began to develop the contest. Early in December, they wrote to the FCC in Washington asking that the verbal approval be confirmed in writing. Nearly a month later, after receiving no reply from Washington, Yaesu National Sales Manager Glenn Malme W6OJF called the FCC and was told by a high-placed official that the contest would have to be cancelled because it was "wrong to give monetary reward to amateurs for doing what they normally do."

Yaesu immediately sent a memo to all dealers cancelling the contest and attempted to pull ads from ham magazines. Because *CQ* went to press early, the ad will appear in that magazine.

The contest was to have been run and results verified by the nationwide network of Yaesu dealers. Malme told *73* that the company was disappointed because of the large investment in advertising and printing. He said that, "Possibly the idea is to qualify hams for sainthood after they become silent keys."

Allied Electronics is offering its *1977 Engineering Manual and Purchasing Guide* to *73* readers free! The book lists hundreds of parts: industrial type electronic parts, components, supplies, and equipment. The 1977 edition uses metric measurements on many listings for the first time. There's wire, cable, solid state devices, test equipment, resistors, trimmers and potentiometers, transformers, switches, timers, connectors, relays, tools, capacitors, new solar energy products, and even a microprocessor. In all, 212 pages . . . and free for the asking. Write Allied Electronics, Dept. 77-F, 401 East 8th Street, Fort Worth TX 76102.

Genave is modifying GTX-202s at its own cost, after "the advertising department got ahead of the production department." A letter from Genave Executive Vice President Claude Henderson WA9COS went to all customers: "We goofed. Our Advertising Department got ahead of our Production Department on the GTX-202, and we advertised some features which had not yet been incorporated in the rig. If you return your rig to us, we'll rapidly modify and update it for you. P.S. We'd like to give you a set of rocks to offset this inconvenience. Please specify your choice, and if they're in stock, we'll install them while we have your rig." An internal memo released to *73* warned employees at Genave: "Let us not goof again by losing radios, charging for crystals, or taking three weeks or longer to turn these radios around." Need we say more?

In the best ham tradition, Art Householder K9TRG, president of Spectronics in Oak Park, Illinois, left the hospital and proceeded directly to the store after suffering a stroke on December 28. In a discussion with Mr. John Perry of Spectronics, it was indicated that Art "will not be kept down" and is ready to return to work. However, he is suffering from slight paralysis of the left leg and requires a crutch to move around the shop.

An 800 channel hand-held? It's about to become reality. As soon as FCC certification is granted, Wilson Electronics will start marketing the WE800 synthesized 2 meter portable. The rig weighs two pounds, measures 8 ¼" by 6 ¾" by 1 7/8", and features an internal nicad pack that gives output power of 2 Watts. With external dc, power jumps to 12 Watts. The CMOS synthesizer circuit features low drain and covers 144-148 MHz in 5 kHz steps. The price has not yet been announced.

Wilson has also announced a line of crank-up towers: the 64 foot SST-64 guyed four section, the TT-45 free standing two section, and the GT-46 46 foot economy tower. They are priced from $219 to $375.

The new Wilson WR1000 rotor is the largest amateur unit on the market, capable of turning over one ton of balanced weight. Suggested list is $429.00.

The Barnstable MA Amateur Radio Club, located on Cape Cod, is currently raising funds for a station to commemorate the 75th anniversary of Guglielmo Marconi's feat of the first two way radio transmission between the United States and Europe. The original rotary spark gap station was located in South Wellfleet MA. The historic transmission took place on January 18, 1903.

The club plans an all band operation that should be ready for tests by this year's field day. Amateurs in England are setting up their own station.

Commemorative envelopes are being sold at ten for $1.50. Contributions can be sent to the station's trustee, R.J. Doherty W1GDB, RFD #1 14 Pine St., Sandwich MA 02563.

The Rochester NY hamfest, largest in the northeast, continues to grow. The 1977 event, to be held May 20-22, will be three days long. The program will be mailed to nearly 10,000 people who have attended in recent years. Plans call for a Friday afternoon flea market to continue through the weekend outdoors, with an indoor flea market open at the same time. Exhibitors will be set up all day Saturday and Sunday in the Rochester Dome Center.
RaRa Rag, *bulletin of the Rochester Amateur Radio Association.*

Normally most of us think of safety in the ham shack as watching out for high voltages inside of equipment, or determining its potential points of appearance at unplanned places due to possible component failure. In this particular instance, this is not the case. We are considering safety with regards to the mobile ham shack, with safety of the shack of prime importance. How many times have you missed your turn-off because you were too engrossed in a QSO? We all probably have at one time or another. Good thing there wasn't anyone in the way at the time or we might not have "seen" them!

Besides paying attention to the driving (it might be better to leave the driving to someone else), you need a good mounting location for your rig, being sure it is stable (i.e., it won't fall on the floor), and within a comfortable reach of the normal driving position.

A channel switching knob shaped so you don't have to look to find the frequency, and can go by feel, is highly recommended.

A touchtone pad is even more difficult to operate if you need two hands (who's steering now?!). It's best under these conditions to pull off the road completely to make the autopatch call. If a call is that important, it's worth stopping for.

So, in conclusion, use common sense and keep the mobile shack and its contents alive. We know of one CARA member who was distracted by his rig falling off his front seat, managed to take a half inch off a telephone pole and about $700 out of the right side of his car, breaking a $3 connector on the rig. So keep your priorities straight!
Reprinted from QRZ, *bulletin of the Middlesex (MA) Amateur Radio Club.*

Those of you scratching your heads over similarities between the October *73* article, "The Hybrid Quad," and "A Hybrid 20 Meter Quad" in January, '77 *QST*, scratch no more . . . they are in fact the same article by the same author. A letter from League headquarters apologized for the error, pointing out that the author had submitted his article to both magazines at the same time. A word to the wise . . .

At deadline, FCC sources told *73* that the WARC comments deadline on the third notice of allocation proposals (see Special Report, February) had been extended to February 7th, with a reply comments limit of February 25th. A petition from the National Association of Broadcasters (NAB) for a 90 day extension was reportedly the reason for the new dates. On the allocations front, our sources say that there is some hope for improvement at the HF level, namely in the 10 MHz range. Chances appear good for a 200 kHz sharing arrangement with fixed services at 10 MHz, based upon the lack of usage there. Incidentally, of our assessment "The WARC Disaster" on the February cover, more than one FCC official said it was *reasonably accurate*, considering the WARC situation.

Broadcasts from station WWV in Fort Collins CO were terminated on 20 and 25 MHz on February 1st. It had earlier been reported that broadcasts on 2.52 and 5 MHz were to also be discontinued, but John Milton, WWV Engineer in Charge, told *73* that the decision was made to retain the frequencies after comments from users indicated a heavier use than had been estimated.

Congratulations to the publishers of the *West Coast DX Bulletin*, located at 77 Coleman Drive in San Rafael CA. This informative weekly newsletter on DXpeditions and DX conditions has passed the 1600 mark in circulation.

BIG-BRIGHT - .5" LED ALARM CLOCK
6 DIGIT AC or DC or ELAPSED TIMER KIT

$19.95 Complete

- PC Board Drilled & Silk Screened (Includes Xtal Time Base Circuitry)
- 5375 Nat. Clock Chip & Fairchild Displays
- Includes EVERY part required for clock and all options except Cabinet and Crystal Time Base components. If desired, see below.
- Brightness Control
- 24 Hr. Alarm w/snooze
- Freeze feat. on every mode
- 0-60 Min. Elapsed Timer
- Field Tested over 1 Yr.
- 12 Hr., 60 Hz oper.

Most Important — Complete Instructions, schematics Pictorials, layouts — everything for trouble free assembly

OPTION — XTAL Time Base Components - $2.95 when purchased w/clock

Clock Kit Accessories

Wooden Case - Walnut gr. incl. Filter ..... **$4.00 each**
Dimension - 6 5/16" W x 2 9/16" H x 3 7/16" D (¼" Material)

Plexiglass Case (Ch. - Bl., White, Blue, & Smoke) incl. Filter ..... **$3.00 each**
Dimensions - 5 13/16" W x 2 1/4" H x 5 3/8" D (⅛ Material)

Individual Filters - Red, Smoke, Blue, Amber and Green ..... **$.60 each**

60 Hz. Crystal Time Base

For: Cars, Boats — Campers, Field Use

$4.95 COMPLETE

KIT INCLUDES: P.C. Board Drilled & Silk Screened
Crystal, MOS 17 Stage Divider IC, all necessary components, Inst. Sheets & Specs.

FEATURES:
- 60 Hz output
- Low Power Drain
- Accuracy
- Small Size
- Direct interface with all MOS Clock Chips

AC/DC - ALARM Clock Kit - 12/24 Hr.

$7.50 quantities of 1 5 — **$6.50** quantities of 5 & up

- **Your choice of Display Colors - Red, Green, Blue, Amber**
- Displays Hrs. & Min. - Switch to Min. & Secs. on Command
- AM/PM Indication
- Field Tested for 6 months

The kit will include a 5316 National Clock Chip, 4 Flourescent Display tubes, all electronic components, switches, controls & complete instructions, specs, etc. for clock and all optional Features. Other parts required or if desired are as follows:

- PC Board, Drilled & Silk Screened for Clock & all options $3.00
- Xformer (for AC oper.) — $1.00
- App. (SCR output) timer kit — $2.00
- Speaker Alarm Kit — $2.00
- Count Down (turn-off) timer kit — $2.00

National MA1001A Digital Alarm Clock Module

including Power Supply

$9.95 complete

- 4 Digit 0.5" Display
- Brightness Cont. Cap.
- 12 Hr. 50/60 Hz. oper.
- Alarm & Snooze Timers

Blinky/Flasher/Timing Kit

$2.50 each — **5 for $10.00**

Kit includes:
P.C. Board, 555 Timer, all components and a connector for a 9V Battery

HOBB-Y-TRONIX, INC.

Box 511, Edison, N.J. 08817

Orders must include Check - No COD's. Add $1.00 handling for orders under $25.00. N.J. residents - add 5% tax. Outside Continental U.S.A., please add postage.

SPECIALS

8080A Microprocessor	$19.95 ea.
21L02-1 Low Power 500NS RAM	$1.95 ea.
.6" Display Common Anode or Cathode	$1.95 ea.
.5" Fairchild Display Com. Anode or Cathode (Same as FTK 0001 & FTK 0002)	79¢ ea.
.8" 3½ Digit Display Module (Same as FTK 0010)	$5.40
LM340T Series Regs. - 5, 6, 12, 15 & 24 V (pos.) Monthly Special	79¢ ~~98¢~~
LM309K - 5 Volt Regulator - Raytheon	79¢
LM741 Op. Amp. 14 Pin Dip Pkg.	4 for 99¢
2N3055 NPN Transistor TO-3 Pkg.	59¢
2N4904 PNP (complement to 2N3055)	69¢
25 Amp - 200 Volt Full Wave Bridge	$1.49
10 Pk - 220 Power Tab Xistors, NPN & PNP Asst.	$1.49
15 Pk - LED's Assorted Sizes and Colors	$1.49
Bi-Polar LED - Red/Green	$1.00

6 Digit LED Stop-Watch Kit

Split Time — **$29.95 complete** — Taylor Time

FEATURES:
- Simple construction needing only the parts listed below
- Small enough for hand held case
- Needs only 3-AA cell batteries

KIT INCLUDES:
- Latest Technology Intersil Mos Chip # 7205
- 3.2768 MHz Crystal
- Variable Trimmer Cap
- 2 mini slide & 3 MOM. PB Switches
- 3 pairs (6 digits) Double Digit LED Displays

P.C. BOARD for above

Hand held case designed for above $3.95

Dual Range DIGITAL Voltmeter Kit

0 to ±2 Volts DC **$39.95** Complete 0 to ±2 Volts DC

- Features latest Technology DVM chip set
- Non Critical Comp.
- High Noise Rejection
- Accuracy to within .001

Contains — P.C. Boards; 4-large .50 Fairchild Readouts; Display Drivers; Op-Amps; Inverter; all electronic comp; Switches, Pots; Complete Instructions and Specs; & DVM Chip Set.

Requirements: Power Supply w/+5V, +15V and -15V.

The LS LINE of TTL

Low Power, High Speed Schottky, Factory Prime

74LS00 — .29	74LS27 — .33	74LS155 — 1.10
74LS02 — .29	74LS30 — .33	74LS157 — 1.10
74LS04 — .32	74LS32 — .35	74LS160 — 1.50
74LS08 — .29	74LS37 — .35	74LS162 — 1.50
74LS10 — .29	74LS38 — .35	74LS163 — 1.50
74LS11 — .33	74LS74 — .50	74LS175 — 1.50
74LS20 — .33	74LS90 — .90	74LS258 — 1.25
74LS21 — .33	74LS132 — .90	74LS367 — .90
74LS22 — .33	74LS138 — .90	74LS368 — .90
	74LS139 — .90	

DL-747
By
Litronix
(Prime)

$1.98 (For 1 to 5) — **$1.79 (Over 6)**

.6 inch Com. Anode

Plastic Unijunction Transistors
By
Motorola (Prime)

Type MU-10

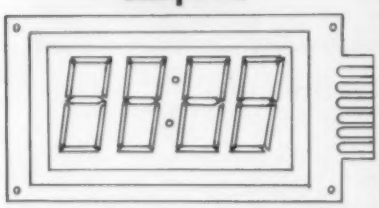
Similar to 2N4870

10 For $3.59

- Accuracy: ±0.05% of Reading ±1 Count
- Two Voltage Ranges: 1.999 V and 199.9 mV
- Up to 25 Conversions/s
- Z_{in} > 1000 M ohm
- Auto-Polarity and Auto-Zero
- Single Positive Voltage Reference
- Standard B-Series CMOS Outputs—Drives One Low Power Schottky Load
- Uses On-Chip System Clock, or External Clock
- Low Power Consumption: 8.0 mW typical @ ±5.0 V
- Wide Supply Range: e.g. ±4.5 V to ±8.0 V

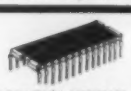
MC14433 SINGLE CHIP 3½ DIGIT A/D
Single chip combines linear and CMOS digital to bring you the simplest yet DVM approach. Requiring only 4 external passive parts, this subsystem gives you: Auto polarity, auto zero, single voltage reference, 8 mW operation, overrange, underrange signals, 25 conversions per second and .05% ± 1 count accuracy! 100 uV resolution. 24 Pin DIP.
MC14433P.....with specs.....$19.55

Complete



MA1003 12VDC Automotive/Instrument Clock Module combines the MM5377 monolithic MOS/LSI clock circuit, a 4-digit 0.3" green vacuum fluorescent display, a 2.097 MHZ crystal and supporting components to form a complete digital clock for 12VDC applications. The module is fully protected against automotive transients and battery reversal conditions with time keeping maintained down to 9V. Automatic display brightness control logic blanks the display with ignition off, reduces brightness to 33% with park or head lamps on and follows the dash lamp dimming control setting. The display features leading zero blanking and has a blinking colon activity indicator. Display may be activated with ignition off or park (head) lights off by closing display switch, allowing minimum power consumption. All you add are the switches and a your choice of filter for the bright green display.
MA1003.....with specs...$17.50.....specs only....60¢

REMOTE CONTROL TRANSMITTER. MC14422P is a 22 channel ultra-sonic remote control transmitter I.C. CMOS uses little power and only a few external passive components. Applications include TV receivers, security controls, toys, industrial controls and locks. 16 pin DIP plastic pkg.
MC14422P..... with specs.....$11.10



MC6525 REMOTE CONTROL RECEIVER
The MC6525 is a 22-channel remote control receiver circuit designed for use in television receivers, industrial remote controls, remote security controls, radio receivers, electronic games and similar applications. The circuit is intended for use with the MC14422 remote control transmitter. Comes in 28 pin DIP plastic package.
MC6525P.....with 6 pages of specs..... $18.38

3 DECADE (BCD) COUNTER CHIP
MC14553BCP consists of 3 negative edge triggered synchronous counters, 3 quad latches and self scan multiplexed , TTL compatible outputs.
MC14553BCP.....$8.72
Spec sheets.....$.60

LM1889 TV VIDEO MODULATOR
The LM1889 is designed to interface audio, color difference, and luminance signals to the antenna terminals of a TV receiver. It consists of a sound subcarrier oscillator, chroma subcarrier oscillator, quadrature chroma modulators, and R.F. oscillators and modulators for two low-VHF channels. The LM1889 allows video information from VTR's, gamies, test equipment, or similar sources to be displayed on black and white or color TV receivers.
LM1889 with 16 pages of data $9.95, data only, $1.00

POWER FETS
N-channel enhancement-mode power fets can be used in switching and amplifier where high current, high speed and linearity are important.
- .No thermal runaway
- .No secondary breakdown
- .CMOS logic compatible input
- .No minority carrier storage
- .High speed switching (4 nSec typical at 1 Amp!)
- .High linear transfer characteristics

Makes very simple high power switches, relay and solenoid drivers, efficient audio power amps, RF amps.....etc.
VMP-1 60V, 25W (TO-3)..... $9.75
VMP-2 60V, 4W (TO-39)..... $6.95
Spec and application sheets for either..... .40

DATA BOOKS BY NATIONAL SEMICONDUCTOR
DIGITAL, Covers TTL, DTL, Tri-State, etc.....$3.95
LINEAR, Covers amplifiers, pre-amps, op-amps... $4.25
LINEAR APPLICATIONS VOLUME I, Dozens of application notes and technical briefs covering the use of op-amps, regulators, phase locked loops and audio amps..... $3.25
LINEAR APPLICATIONS VOLUME II, Takes up where Volume I left you--All the latest linear devices. Along with Vol I you have a great source of application data on the most widely used devices as well as new types just appearing.....$3.25
CMOS Gates, Flip Flops, registers, etc.....$3.00
VOLTAGE REGULATORS, A must for anyone making a power supply. Complete theory including transformers, filters, heat sinks, regulators etc..... $3.00
MEMORY, Info on MOS and Bipolar memories, RAMS ROMS, PROMS and decoder/encoders..... $3.95
INTERFACE, Covers peripheral drivers, level translators, line driver/receivers, memory and clock drivers, sense amps, display driver and opto-couplers..... $3.95
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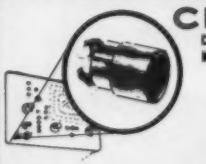
IF YOUR PROJECT TIME AND MONEY ARE BEING BLOWN AWAY BY DELAYS AND HIGH PRICES---
****** MARCH ON DOWN TO TRI-TEK! *******

OK MACHINE AND TOOL CORPORATION

HOBBY-WRAP TOOL

HOBBY-WRAP TOOL
Battery operated with built-in 30 ga bit and sleeve. Uses standard C batteries (not included). Light weight, only 11 oz. Wraps standard DIP sockets. Has built in device to prevent overwrapping. Pistol grip, positive indexing. Quality construction assures exceptional performance. BW-630.....$34.95
FREE, a 50' roll of wire wrap wire with each tool!!!

HOBBY-WRAP-30 Handy little tool to strip, wrap and unwrap 30 gauge wire.....$5.95



CLIPLITE™
COMBINATION LENS AND MOUNTING DEVICE FOR T 1¾ LED

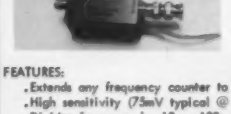
REQUIRES NO TOOLS

SNAP CLIPLITE

INSERT LED
AVAILABLE IN TRANSPARENT RED-GREEN-AMBER-CLEAR & YELLOW

CLIPLITE
Combination lens and mounting device for T 1-3/4 LED. The CLIPLITE combines the benefits of the present LED display panel mounting methods and eliminates their deficiencies. Requires no special tools and installs in 6 seconds in .250" hole. Simple two-step installation. Just snap CLIPLITE, insert LED. Available in transparent red, green, amber, clear and yellow. Specify colors, any mix.
5/$1.00, 10/$1.90, 20/$3.50, 50/$7.50, 100/$13.50

UHF PRESCALER
The model PS-500 UHF prescaler plugs directly onto your frequency counter to extend its counting range to 500MHZ or more. It performs well with all brands of frequency counters, including home-brew types. The output frequency of VHF and UHF tranceivers can be easily measured by merely connecting a length of wire to the input jack of the PS-500.



$59.95

FEATURES:
- .Extends any frequency counter to 500MHz
- .High sensitivity (75mV typical @ 450MHz)
- .Divides frequency by 10 or 100, switch selectable
- .Plugs directly onto your counter input
- .Compact size (only 1½ X 1½ X 2½ inches.)
- .Completely assembled and tested

PS-500..... $59.95

TRI-TEK, INC.
6522 NORTH 43RD AVENUE,
GLENDALE, ARIZONA 85301
phone 602 - 931-4049

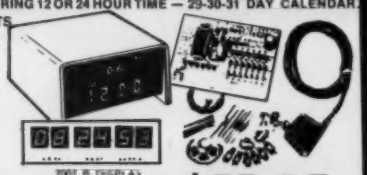
We pay surface shipping on all orders over $10 US, $15 foreign in US funds. Please add extra for first class or air mail. Excess will be refunded. Orders under $10, add $1 handling. Please add 50c insurance. Master charge and Bank America cards welcome, ($20 minimum). Telephone orders may be placed 10AM to 5:30PM daily, Mon thru Fri. Call 602-931-4528. Check reader service card or send stamp for our latest flyers packed with new and surplus electronic components.

6-DIGIT LED CLOCK CALENDAR KIT

DATE-TIME-SNOOZE ALARM & MORE... KIT 7001

OUR TOP OF THE LINE KIT FOR THE BUILDER THAT WANTS THE BEST. A TOTAL PACKAGE, FEATURING 12 OR 24 HOUR TIME — 29-30-31 DAY CALENDAR, WITH ALARM, SNOOZE AND AUX. TIMER CIRCUITS

Will alternate time (8 seconds) and date (2 seconds) or may be wired for time or date display only, with other functions on demand. Has built-in oscillator for battery back-up. A loud 24 hour alarm with a repeatable 10 minute snooze alarm, alarm set & timer set indicators. Includes 110 VAC/60Hz power pack with cord and top quality components through-out.



COMPLETE KIT WITH YOUR CHOICE OF DIGITAL DISPLAYS

KIT - 7001B WITH 6 - .4" DIGITS $39.95
KIT - 7001C WITH 4 - .6" DIGITS & 2 - .3" DIGITS FOR SECONDS $42.95
KIT - 7001X WITH 6 - .6" DIGITS $45.95

7001 X DISPLAY

7001C DISPLAY

7001 B DISPLAY

KITS ARE COMPLETE (**LESS CABINET**) WITH PC BOARDS, POWER SUPPLY, IC & SOCKET, 16 TRANSISTORS, 9 SWITCHES AND ALL REQUIRED PARTS. ALL 7001 KITS FIT CABINET I AND ACCEPT (OPTIONAL) QUARTZ CRYSTAL TIME BASE KIT # TB-1

$39.95 ea.

6 DIGIT LED CLOCK KIT #850-4

12/24 HR. OPERATION BIG .4" DIGITS - 50/60 HZ OPERATION.

KIT INCLUDES
- INSTRUCTIONS
- QUALITY COMPONENTS
- 50 or 60 Hz OPERATION
- 12 or 24 HR OPERATION

6-LED Readouts (FND-359 Red, com. cathode)
1-MM5314 Clock Chip (24 pin)
13-Transistors
3-Switches
6-Capacitors
5-Diodes
9-Resistors
24-Molex pins for IC socket

LARGE .4" DIGITS! ORDER KIT #850-4 AN INCREDIBLE VALUE!

$11.95 ea. QTY. 1-5
$10.95 ea. QTY. 6-11
$9.95 ea. QTY. 12 OR MORE

"Kit #850-4 will furnish a complete set of clock components as listed. The only additional items required are a 7-12 VAC transformer, a circuit board and a cabinet, if desired."

PRINTED CIRCUIT BOARD FOR KIT # 850-4, SCREEN PRINTED DRILLED AND SOLDER PLATED FIBERGLASS $2.95
MINI-BRITE RED LED'S (FOR COLON IN CLOCK DISPLAY) ..... Pkg. of 5-$1.00
MOLDED PLUG TRANSFORMER 115/10 VAC (WITH CORD) $2.50

NOTE: Entire Clock may be assembled on one PC Board or Board may be cut to remote display. Kit # 850-4 will fit Plexiglas Cabinet II.

MOBILE LED CLOCK

12 OR 24-HOUR OPERATION
12 VOLT AC or DC POWERED FOR FIXED OR MOBILE OPERATION.
SIX LARGE .4" DIGITS!
Approx. Size: 1¾"H x 4"W x 4½"D

MODEL #2001

- 6 JUMBO .4" RED LED'S BEHIND RED FILTER LENS WITH CHROME RIM
- SET TIME FROM FRONT VIA HIDDEN SWITCHES • 12/24-Hr. TIME FORMAT
- STYLISH CHARCOAL GRAY CASE OF MOLDED HIGH TEMP. PLASTIC
- BRIDGE POWER INPUT CIRCUITRY — TWO WIRE NO POLARITY HOOK-UP
- OPTIONAL CONNECTION TO BLANK DISPLAY (Use When Key Off In Car, Etc.)
- TOP QUALITY PC BOARDS & COMPONENTS - EXCELLENT INSTRUCTIONS
- MOUNTING BRACKET INCLUDED

KIT #2001 COMPLETE KIT (Less 9V. Battery) **$28.95** EA. 3 OR MORE **$27.95** EA.
115 VAC Power Pack #AC-1 **$2.50** EA.

ASSEMBLED UNITS WIRED & TESTED ORDER #2001 WT (LESS 9V. BATTERY) **$39.95** EA. 3 OR MORE **$37.95** EA. Assembled Units May Be Mixed With Kits for Qty. Price
WIRED FOR 12 VAC OR IF NOT SPECIFIED OTHERWISE

JUMBO DIGIT CLOCK KIT
A complete Kit (less Cabinet) featuring: six .5" digits, MM5314 IC, 12/24 Hr. time, 50/60 HZ., Plug-Transformer, Line Cord, Switches, and all Parts. (Ideal Fit in Cabinet II)
Kit # 5314-5 .... **$19.95 ea. 2/$38.**

JUMBO DIGIT CONVERSION KIT $9.95 ea.
Convert small digit LED clock to large .5" displays. Kit includes 6 - .5" LED's, Multiplex PC Board & easy hook-up info.
Kit # JD-1CC For common Cathode
Kit # JD-1CA for common Anode

PRINTED CIRCUIT BOARDS for CT-7001 Kits sold separately with assembly info. PC Boards are drilled Fiberglass, solder plated and screened with component layout.
Specify for 7001 *B, C or D* - $7.95

TELEPHONE FORMAT KEYBOARD
BY Chomerics
$4.95 2-1/4"x3" 5/32" thick
6/$28. # EF-21360

25 AMP BRIDGE
$1.95 ea.
3/$5.00
100 PIV

PLEXIGLAS CABINETS
Great for Clocks or any LED Digital project. Clear-Red Chassis serves as Bezel to increase contrast of digital displays.

CABINET I
3"H, 6¼"W, 5½"D

CABINET II
2½"H, 5"W, 4"D

Black, White or Clear Cover

ANY SIZE/COLOR **$6.50 ea. 2/$12.**

RED OR GREY PLEXIGLAS FOR DIGITAL BEZELS
3"x6"x1/8" **95¢ ea. 4/$3**

7-SEG LED

COMMON CATHODE

COLOR	HT.	DEC PT	PR EA.
FND-359 RED	.4"	RHDP	$ .95
FND-503 RED	.5"	RHDP	$1.35
DL-750 RED	.6"	LHDP	$2.95
XAN-654 GREEN	.6"	NDP	$1.95
XAN-664 RED	.6"	NDP	$1.95

COMMON ANODE

DL-747	RED	.6"	LHDP	$1.95
XAN-72	RED	.3"	LHDP	$1.25
MAN-72	RED	.3"	LHDP	$1.25
XAN-81	YELLOW	.3"	RHDP	$1.75
XAN-351	GREEN	.3"	RHDP	$1.50
XAN-361	RED	.3"	RHDP	$1.50
XAN-362	RED	.3"	LHDP	$1.50
XAN-662	RED	.6"	NDP	$1.95
XAN-682	RED	.6"	NDP	$1.95

SCHOTTKY TTL

74S00	$ .35
74S01	.40
74S04	.55
74S05	.00
74S09	.55
74S10	.40
74S20	.50
74S22	.45
74S40	.45
74S50	.45
74S51	.55
74S60	.85
74S64	.55
74S74	.85
74S75	1.75
74S78	1.50
74S86	.95
74S107	.95
74S112	.95
74S113	1.40
74S114	.95
74S133	.75
74S134	.75
74S138	1.75
74S139	1.50
74S151	1.95
74S153	1.95
74S155	1.95
74S156	1.95
74S157	1.80
74S158	2.50
74S174	2.50
74S175	2.50
74S181	2.95
74S182	1.95
74S251	2.75

DIGITAL CLOCK IC's

MM5312	$ 4.95
MM 5314	3.95
MM 5375 AB	3.95
CT-7001	7.95
CT-7002	13.95
50380	3.95
MM 5369	2.50

LED DRIVERS

7447	$ .95
7448	.95
75491	.65
75492	.65

VOLTAGE REGULATORS

LM 309 H	TO-5	$ .95
LM 309 K	TO-3	1.25
7805	TAB	.95
7812	TAB	1.25
7812	TO-3	1.50
7815	TO-3	1.25
7815	TAB	1.25
78L 15	TO-5	.75
7824	TO-3	1.25
723	DIP	.75
723	TO-5	.75

PROM

1702	E Prom $ 8.95
5203	E Prom $ 8.95

SWITCHES

ROCKER SPDT	6/$1
MINI-SLIDE SPDT	5/$1
REG. SLIDE DPDT	6/$1
PUSH BUTTON N.O.	3/$1
MINI SPDT	$1.30
TOGGLE DPDT	1.50

IC SOCKETS

PINS	1-24	25	100
8	$ .25	$ .22	$ .20
14	.25	.22	.20
16	.28	.25	.23
18	.31	.28	.28
24	.50	.45	.40
28	.60	.55	.50
40	.75	.70	.65

XTAL
3.579545 MHZ. $1.95

EXAR

XR 2556	$ 1.75
XR 2567	$ 1.95

TRANSISTORS

2N2222	TO-18	5/$1.00
2N2564	TO-5	2/$1.00
2N2712	TO-98	5/$1.00
2N3415	TO-92	5/$1.00
2N3704	TO-92	5/$1.00
2N4400	TO-92	5/$1.00
2N4125	TO-92	5/$1.00
2N4249	TO-92	5/$1.00
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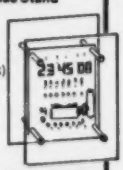

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	7	7	7	7	7	7	7A	14	14
ARGENTINA	14	7A	7B	7B	7	7	14	14	14	14A	21	14A
AUSTRALIA	14A	14	7B	7B	7B	7	7	7A	14	14	14	14
CANAL ZONE	7A	7	7	7	7	7	7A	14	14	14A	21	14A
ENGLAND	7	7	7	7	7	7	14	14	14	14	14	7A
HAWAII	14	14	7B	7	7	7	7	7	7A	14	14	14
INDIA	7	7	7B	7B	7B	7B	7A	14	14	7	7	7
JAPAN	14	7B	7B	7B	7B	7	7	7	7	7	7	14
MEXICO	14	7A	7	7	7	7	7	7A	14	14	14A	14
PHILIPPINES	14	7B	7B	7B	7B	7B	7B	7	7A	7A	7B	14
PUERTO RICO	7A	7	7	7	7	3A	7A	14	14	14	14	14
SOUTH AFRICA	7A	7	7	7	7B	7B	14	14	14A	14A	14	14
U. S. S. R.	7	7	7	7	7	7B	7A	14	14	14	7B	7
WEST COAST	14	7A	7	7	7	7	7	7A	14	14	14A	14

CENTRAL UNITED STATES TO:

ALASKA	14	7A	7	7	7	7	7	7	7	7A	14	14
ARGENTINA	14	14	7B	7B	7	7	7B	14	14	14	21	14A
AUSTRALIA	21	14	7B	7B	7B	7	7	7	14	14	14	14A
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	7	7	7	7	7	7	7B	14	14	14	14	7B
HAWAII	14A	14	7B	7	7	7	7	7	7A	14	14	14A
INDIA	7	7A	7B	7B	7B	7B	7B	7B	14	7	7	7
JAPAN	14	14	7B	7B	7B	7	7	7	7	7	7	14
MEXICO	14	7A	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	7A	7A	7B	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	14	14A	14	14
U. S. S. R.	7	7	7	7	7	7	7B	7B	14	14	7B	7B

WESTERN UNITED STATES TO:

ALASKA	14	14	7A	7	7	7	7	7	7	7A	14	14
ARGENTINA	14	14	7B	7B	7	7	7B	14	14	14	14A	21
AUSTRALIA	21	21	14	14	7B	7	7	7	7A	14	14	14A
CANAL ZONE	14	14	7	7	7	7	7	14	14	14A	21	21
ENGLAND	7	7	7	7	7	7	7B	7B	14	14	14	7B
HAWAII	21	14A	14	14	7	7	7	7	7A	14	14	14A
INDIA	7	14	14	7B	7B	7B	7B	7B	7	7A	7	7
JAPAN	14	14	14	7B	7B	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7B	7	7	7	7B	14
PUERTO RICO	14	7A	7	7	7	7	7	14	14	14A	14A	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	7A	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	7B	7	7A	7A	7B	7B
EAST COAST	14	7A	7	7	7	7	7	7A	14	14	14A	14

A = Next higher frequency also may be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor

MARCH

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1 F	2 G	3 G	4 F	5 P
6 F	7 G	8 G	9 G	10 G	11 F	12 P
13 F	14 G	15 G	16 G	17 F	18 F	19 F
20 P	21 G	22 G	23 G	24 G	25 P	26 F
27 F	28 F	29 P	30 P	31 F		

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